PROCEEDINGS

for the

ADVANCE PLANNING BRIEFING FOR INDUSTRY

TECHNOLOGY TO WIN

US ARMY LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

at
U.S. Army Adelphi Laboratory Center
Adelphi, Maryland
23–24 January 1990

APPROVED FOR PUBLIC RELEASE;

DISTRIBUTION UNLIMITED

UNCLASSIFIED

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Proceedings for the Advanced Planning Briefing for Industry U.S. Army Laboratory Command/Harry Diamond Laboratories (U)

12. PERSONAL AUTHOR(S)
Compiled by Melvyn J. Shichtman, Mary S. Binseel, Dorothy J. Aldrich

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16. SUPPLEMENTARY NOTATION

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	Advanced Field Artillery System, Artificial Intelligence, Acousto-Optic, APBI-Advance Planning Briefing for Industry, APCP-Army Potential Contractor Program ~~(see continuance)~~

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

The objective of the Advance Planning Briefing for Industry (APBI) was to:

a. Present technologies in which the U.S. Army Laboratory Command (LABCOM) and Harry Diamond Laboratories (HDL) have interest in and are planning to pursue for the mid- and long-term.

b. Show the private sector a preview in order to assure that industry research and development investments coincide with the needs of the Army.

HDL performs and provides basic and applied research, explanatory and advanced development, technology leadership and evaluation and initial procurement to support the following mission areas: Nuclear Survivability, High-Power Microwave Survivability and Source Technology, Electronic Fuzing and Smart Munitions, Radar Technology, Anti-Radiation Missle Countermeasures and Information/Signal Processing. (Keywords.)

The proceedings for the APBI provides advance planning information in the following areas: Global Position System, Fuzing, Battlefield Automation, (see continuance)

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT: ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION: UNCLASSIFIED
22a. NAME OF RESPONSIBLE INDIVIDUAL: MELVYN J. SHICHTMAN	22b. TELEPHONE (Include Area Code): (202)394-3880; 22c. OFFICE SYMBOL: AMSLC-CM

DD Form 1473, JUN 86 Previous editions are obsolete.

SECURITY CLASSIFICATION OF THIS PAGE

UNCLASSIFIED

18. SUBJECT TERMS - continued

ATACMS - Army TACtical Missile System
Broad Agency Announcement
Electronic Countermeasures
Electronic Counter-Countermeasures
EMP - ElectroMagnetic Pulse
Electronic Safing and Army Guidance Integrated Fuzing
Global Positioning System
HDL - Harry Diamond Laboratories
LABCOM
LB/TS - Large Blast/Thermal Simulator
Liquid Crystal Display
MMIC - Monolithic Millimeter wave Integrated Circuit
Multi-Option Fuze for Artillery
NSAT - Nuclear Survivability Assessment Team
OEIC - OptoElectronic Integrated Circuits
RDTE
RSTA - Reconnaissance, surveillance and Target Acquisition
SADBU - Small and Disadvantaged Business Utilization
SAR - Synthetic Aperture Radar
Standing Acoustic Wave
TILO - Technical and Industrial Liaison Office

19. ABSTRACT - continued

Nuclear Survivability and Nuclear Weapons Effects Technology, Radiation Simulation, Domestic Technology Transfer, Radar Technology, Signal Processing Technology, Automated Assembly of Electronics Circuits, LABCOM Small Business Programs and Industrial Liaison Programs.

DEPARTMENT OF THE ARMY
HEADQUARTERS, U.S. ARMY LABORATORY COMMAND
2800 POWDER MILL RD., ADELPHI, MD 20783-1145

REPLY TO
ATTENTION OF

AMSLC-CM (70-35)

5 July 1990

MEMORANDUM FOR Administrator, Defense Technical Information Center, ATTN: DTIC-FDAC, Building 5, Cameron Station, Alexandria, VA 22304-6145

SUBJECT: Advance Planning Briefing for Industry Proceedings.

1. Enclosed are two (2) copies of the Proceedings for the U.S. Army Laboratory Command (LABCOM), Harry Diamond Laboratories (HDL) Advance Planning Briefing for Industry (APBI), held at the Adelphi Laboratory Center on 23-24 January 1990. This publication is unclassified and approved for public release; distribution unlimited.

2. Point of contact is Mr. Melvyn J. Shichtman, LABCOM Technical and Industrial Liaison Officer, (202) 394-3883.

FOR THE COMMANDER:

Joyce E. Sweasy

JOYCE E. SWEASY
Competition Advocate

2 Encls
1. 2 copies of proceedings
2. DD Form 1473

CF (wo/encls):
AMSLC-PA (Ms. Singleton)
AMSLC-MI-SS (Ms. Richeson)
SLCHD-D-PA (Ms. Coleman)
SLCHD-PO-P (Mr. Polimadei)

Headquarters, Laboratory Command

and

Harry Diamond Laboratories

present

1990 Advance Planning Briefing for Industry (APBI)

Melvyn J. Shichtman,
Technical and Industrial
Liaison Officer,
Headquarters, Laboratory Command

and

Mary S. Binseel
and
Dorothy J. Aldrich,
Plans Branch,
Harry Diamond Laboratories

Supported by:
American Defense
Preparedness Association

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DISTRIBUTION UNLIMITED

DEPARTMENT OF THE ARMY
UNITED STATES ARMY LABORATORY COMMAND
HARRY DIAMOND LABORATORIES
2800 POWDER MILL RD., ADELPHI, MD 20783-1197

REPLY TO
ATTENTION OF

Office of the Director

Ladies and Gentlemen:

I am excited about the opportunity the next two days will bring to everyone participating in this session of advance planning.

The future is full of challenges for all of us who are concerned with the defense of our nation. The recent events around the world have kept us on the edges of our seats, wondering what will happen next. In many ways, it's a whole new world out there, and we are going to be tested on our flexibility, and on the vigor with which we respond to these new challenges.

I have immense confidence, not only in the talents and dedication of the people of Harry Diamond Laboratories and all of Laboratory Command, but also in the abilities of our counterparts in the private sector.

As we exchange information during these days, I hope that the synergism created here will inspire all of us to rededicate ourselves to ensuring that our armed forces have the highest quality equipment. Even with the reduced tensions that appear to lie ahead, the people who have committed themselves to protecting our country and our world deserve the best we can give them.

Welcome to all of you. Harry Diamond Laboratories is pleased to host these two days, and we look forward to a pleasant and productive interchange and constructive future relationships with you.

Jerry L. Reed

JERRY L. REED
Director

ACKNOWLEDGMENTS

The organizers of this Advance Planning Briefing for Industry wish to acknowledge and thank the following personnel:

Ms. Jackie Richeson, LABCOM Office of the Deputy Chief of Staff for Intelligence, Security/Counterintelligence Division, for her advice and assistance regarding conference security concerns;

Ms. Sherrie Curtis and **Mrs. Maryann Biggins**, ISA Physical Security Office, for their advice and assistance regarding visitor control;

Ms. Marian Singleton, LABCOM Public Affairs Office, for her advice and assistance in clearing the LABCOM briefings for public release; and

Ms. Cathy Coleman, HDL Public Affairs Officer, for her advice and assistance in clearing the HDL briefings for public release.

Further, the organizers of this event wish to thank **MG Jerry Harrison**, Commander, LABCOM; **Mr. Richard Vitali**, LABCOM Director of Corporate Laboratories; **Mr. Jerry Reed**, Director, Harry Diamond Laboratories; **Dr. John Scully**, Deputy Director, Harry Diamond Laboratories; and **Dr. Joseph Sattler**, Chief Scientist, Harry Diamond Laboratories for their support which ensured the success of the Advance Planning Briefing for Industry and to **Mr. David Overman**, Chief, Mechanical Systems Branch, Harry Diamond Laboratories, and **Mr. Raymond Femenias**, Plans Branch, Harry Diamond Laboratories for their assistance in the initial planning phases of this event.

GLOSSARY OF ACRONYMS

A/C - Aircraft

AFAS - Advanced Field Artillery System

AI - Artificial Intelligence

AMC - Army Materiel Command

AMCCOM - Armaments, Munitions and Chemical COMmand

AO - Acousto-Optic

APBI - Advance Planning Briefing for Industry

APCP - Army Potential Contractor Program

ASL - Atmospheric Sciences Laboratory

ATACMS - Army TACtical Missile System

ATM - Anti-Tactical Missile

BAA - Broad Agency Announcement

BRL - Ballistic Research Laboratory

CBD - Commerce Business Daily

CM - Configuration Management

DSREDS - Digital Storage and Retrieval Engineering Data System

DLA - Defense Logistics Agency

DNA - Defense Nuclear Agency

DSSP - Defense Standards and Specifications Program

DTIC - Defense Technical Information Center

ECM - Electronic Countermeasures

ECCM - Electronic Counter-Countermeasures

EMP - ElectroMagnetic Pulse

ERA II - Extended Range ARtillery Projectile II

ESA - Electronic Safing and Arming

ETDL - Electronic Technology and Devices Laboratory

FAADS-LOS-F-H - Forward Area Air Defense - Line Of Sight - Forward - Heavy

GIF - Guidance Integrated Fuzing

GPS - Global Positioning System

HDL - Harry Diamond Laboratories

HEL - Human Engineering Laboratory

HEMP - High altitude ElectroMagnetic Pulse

HIMADS - HIgh to Medium Altitude Air Defense System

ILS - Integrated Logistic Support

INR - Initial Nuclear Radiation

IRAD - Independent Research And Development

LABCOM - Laboratory Command

LB/TS - Large Blast/Thermal Simulator

LCD - Liquid Crystal Display

LICRS - Low Intensity Conflict Rocket System

LOS - Line Of Sight

LPI - Low Probability of Intercept

LSAA - Long-Standoff Anti-Armor

MIL-STD - Military Standard

MLRS - Multiple Launch Rocket System

MMAAWS - Multimode Antiarmor Weapon System

MMIC - Monolithic Millimeter wave Integrated Circuit

MMT - Manufacturing Methods and Technology

MOB - MOBilization

MOFA - Multi-Option Fuze for Artillery

MSAM - Medium range Surface to Air Missile

NAVAID - NAVigational AID

NC - Numerical Control

NDI - Non-Developmental Item

NSAT - Nuclear Survivability Assessment Team

OEIC - OptoElectronic Integrated Circuits

PM-AAWS-M - Program Manager, Advanced Antitank Weapon Systems - Medium

PM-AFAS - Program Manager, Advanced Field Artillery System

PM-TOW - Program Manager, Tube launched Optically tracked Wire guided missile

POC - Point of Contact

RDTE - Research, Development, Test and Evaluation

RSTA - Reconnaisance, Surveillance and Target Acquisition

SADBU - Small And Disadvantanged Business Utilization

SAR - Synthetic Aperture Radar

SAW - Standing Acoustic Wave

SLMs - Surface Launched Missiles

TACAWS - The Army Counter-Air Weapon System

TDP - Technical Data Package

TILO - Technical and Industrial Liaison Office

TOD - Technical Objective Documents

TSR - Tactical Source Region

UAV - Unmanned Aerial Vehicle

UGT - UnderGround nuclear Test

AGENDA

TUESDAY, 23 JANUARY 1990

0700–0830 **Late Registration and Security Check-in.** Lob. , Building 205, U.S. Army Adelphi Laboratory Center, 2800 Powder Mill Road, Adelphi, Maryland

OPENING SESSION

0830 **Administrative Remarks.** Melvyn J. Shichtman, Technical and Industrial Liaison Officer, U.S. Army Laboratory Command

0840 **Security Considerations.** Office of the Deputy Chief of Staff for Intelligence

0845 **Welcome Remarks.** Major General Jerry C. Harrison, Commander, U.S. Army Laboratory Command

0855 **Symposium Purpose and Overview.** Richard Vitali, Director of Corporate Laboratories

0905 **User Requirements.** James F. Fox, Scientific Advisor, Combined Arms Combat Development Activity, U.S. Army Training and Doctrine Command

1000 **Overview of Harry Diamond Laboratories.** Jerry L. Reed, Director, Harry Diamond Laboratories

1030 **Break**

SESSION I

TECHNOLOGY APPLICATIONS

Session Chairman:
Philip F. Ingersoll
Director, Technology Applications Laboratory

1100 **Introduction.** Philip F. Ingersoll, Session Chairman

1105 **Global Positioning System.** John S. Eicke, Electronics Engineer, Tactical Systems Branch

1135 **Fuzing.** William L. Konick, Fuzing Manager

1210 **Battlefield Automation.** Dr. Philip J. Emmerman, Chief, Advanced Sensor Systems

1240 **Lunch.** Cafeteria

SESSION II

NUCLEAR SURVIVABILITY

Session Chairman:
Dr. John C. Ingram
Deputy Director, Nuclear Survivability Laboratory

1350 **Overview.** Dr. John C. Ingram, Session Chairman

1405 **Nuclear Survivability Technology.** James H. Gwaltney, Chief, Nuclear Survivability Program Office
- High-Altitude EMP
- Blast/Thermal Radiation
- Tactical Source Region

1505 **Break**

1540 **Nuclear Weapons Effects Hardening Technology.** John J. Corrigan, Nuclear Survivability Program Office
- Hardness Assurance/Hardness Maintenance
- Nondevelopmental Items (NDI)
- Defense Standards and Specifications Program
- Large Blast/Thermal Simulator

1635 **Nuclear Survivability Assessments.** Roland A. Polimadei, Nuclear Survivability Program Office
- Nuclear Effects Support Term
- Nuclear Survivability Assessment Team

1655 **Aurora/Radiation Simulation Technology.** Dr. Forrest J. Agee, Chief, Simulation Technology Branch

1705 **Adjourn**

1800–1930 **Reception.** Holiday Inn - Calvert- -, 4905 Powder Mill Road, Beltsville, MD

WEDNESDAY, 24 JANUARY 1990

0730–0830 **Security Check-In.** Lobby - Bu ng 205, U.S. Army Adelphi Laboratory Center, 2F Powder Mill Rd., Adelphi, MD

0830 **Opening Session**

0830 **Administrative Remarks.** Melvyn J. Shichtman, Technical and Industrial Liaison Officer, U.S. Army Laboratory Command

0835 **Domestic Technology Transfer Opportunities.** Clifford E. Lanham, Army Domestic Technology Transfer Manager

SESSION III

TARGET SENSORS AND SIGNAL PROCESSING

Session Chairman:
Peter B. Johnson
Director, Target Sensors and Signal Processing Laboratory

0900 **Introduction.** Peter B. Johnson, Session Chairman

0905 **Radar Technology.** John M. David, Chief, Radar Branch

0935 **Fuzing Technology.** Dr. Z. G. Sztankay, Chief, Sensor Physics Branch

1005 **Signal Processing Technology.** Dr. John M. Pellegrino, Chief, Optical Processing Technology Branch

1035 **Break**

SESSION IV

ENGINEERING AND TECHNICAL SUPPORT

Session Chairman:
Ira R. Marcus
Associate Director, Engineering and Technical Support Division

1100 **Introduction.** Ira B. Marcus, Session Chairman

1105 **Automated Assembly of Electronics Circuits.** George K. Lucey, Jr., Chief, Systems Engineering Branch

1135 **U.S. Army Laboratory Command Small Business Programs.** Thomas K. Rogers, Chief Small and Disadvantaged Business office

1205 **Industrial Liaison Programs.** Melvyn J. Shichtman, Technical and Industrial Liaison Officer, U.S. Army Laboratory Command

1230 **Symposium Wrap-Up.** Jerry L. Reed, Director, Harry Diamond Laboratories

1235 **Adjourn**

U. S. ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

OVERVIEW
OF
HARRY DIAMOND LABORATORIES

ADVANCE PLANNING BRIEFING FOR INDUSTRY
23 JANUARY 1990

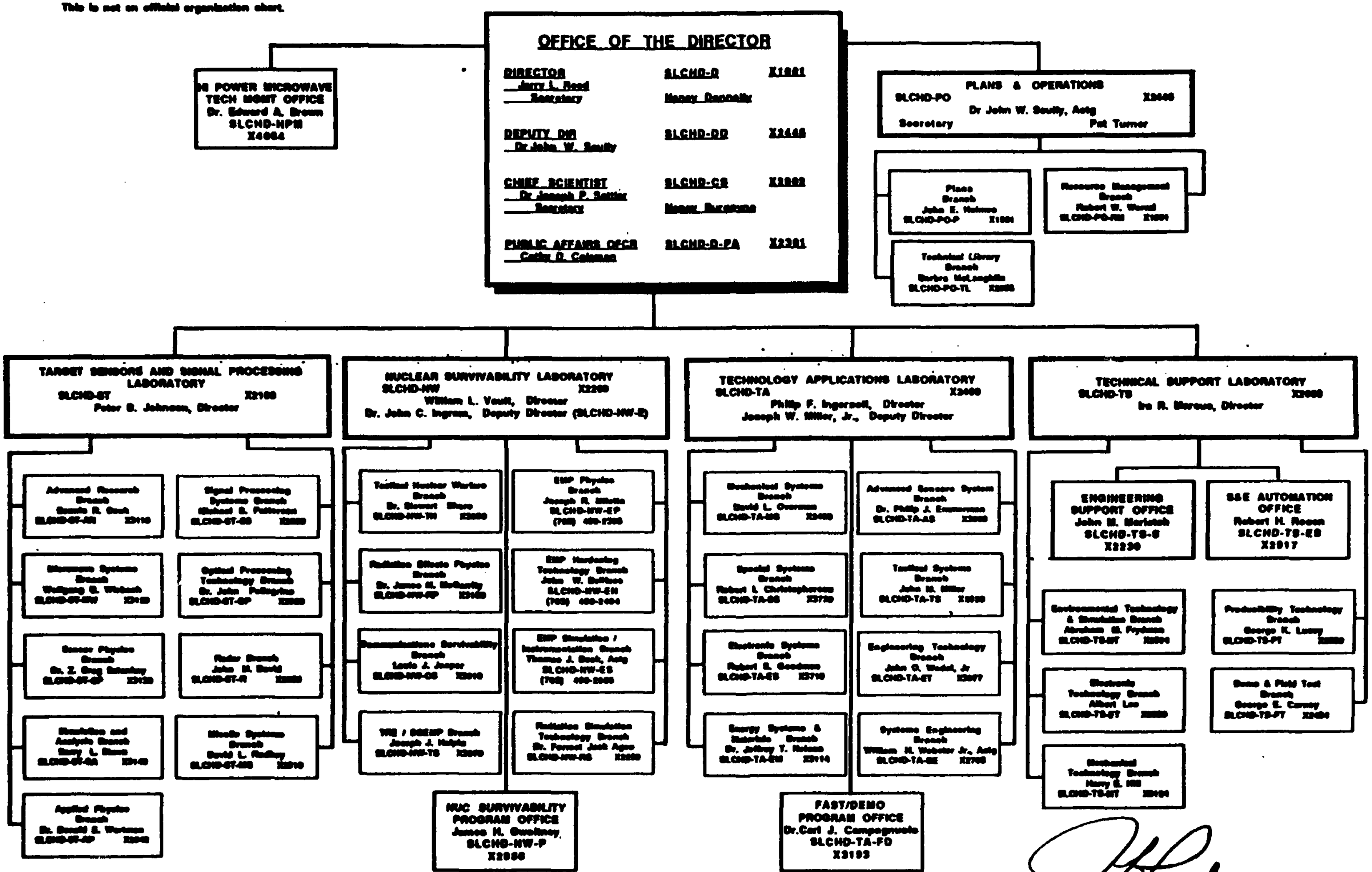
PRESENTED BY

MR. JERRY L. REED
DIRECTOR

HARRY DIAMOND LABORATORIES
2800 Powder Mill Road
Adelphi, Maryland 20783-1197

Commercial (301) 394-XXXX
Autovon 290-XXXX
Facsimile 394-1005

This is not an official organization chart.



Approved: Jerry L. Reed, Director

As of 31 January 1990

OVERVIEW

U. S. ARMY
LABORATORY COMMAND

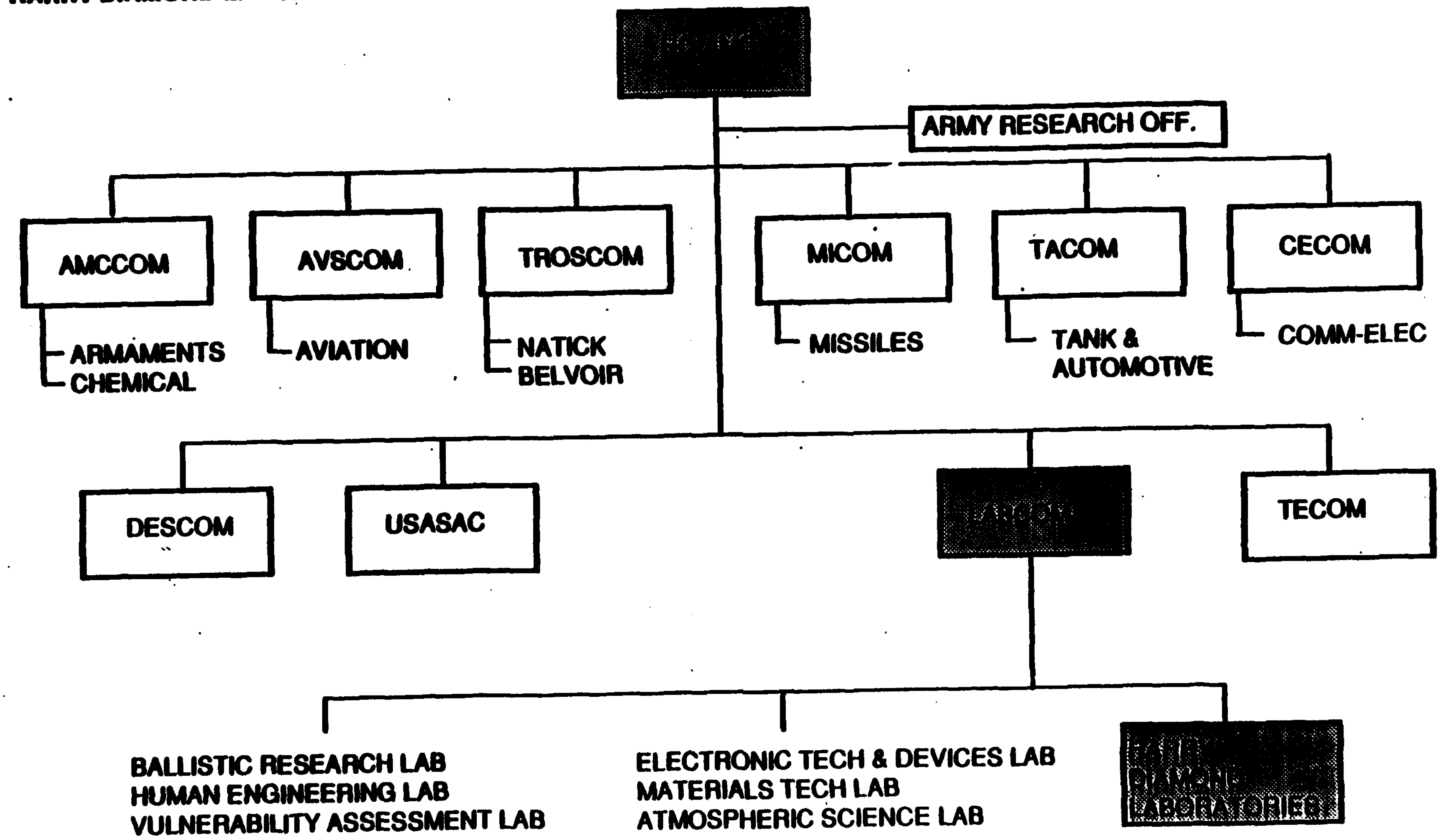
HARRY DIAMOND LABORATORIES

- Organization
- Mission
- FY 90 Funding Profile

AMC RDA ORGANIZATION

U. S. ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES



LABCOM
CORPORATE LABORATORIES

U. S. ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

Atmospheric Sciences Lab
Weather measurement
Atmospheric effects

Ballistic Research Lab
Lethality
Survivability
Vulnerability/lethality assessment

Electronics Technology & Devices Lab
Electronic devices
Power sources

Harry Diamond Labs

Human Engineering Lab
Human factors
Robotics

Materials Technology Lab
Multi-disciplinary materials

Vulnerability Assessment Lab
Electronic warfare

HARRY DIAMOND LABORATORIES

U. S. ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

DIRECTOR

Deputy Director

HPM Technology Mgmt Office

Plans & Operations Office

Target Sensors and Signal Processing Laboratory

- Anti-Radiation Missile Countermeasures
- Physics Research: Optics & GaAs
- Optical & Digital Signal Processing
- Radar & Sensor Technology
- Fuze Technology

Nuclear Survivability Laboratory

- Nuclear Radiation Effects Survivability
- Electromagnetic Effects Survivability
- Nuclear Survivability Program Office
- Aurora (DNA)
- EMP Testing

Technology Applications Laboratory

- Technology Demos
- Fuze Research & Development
- Battlefield Information Fusion Technology
- Reserve Power Supplies
- FAST Office

Technical Support Laboratory

- Electronic & Mechanical Fabrication
- Environmental, Field, & Demo Testing
- S&E Computing Services
- Producibility Studies
- Quality Assurance & ILS

HDL MISSION

U. S. ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

HDL performs and provides basic and applied research, exploratory and advanced development, technology leadership and evaluation and initial procurement to support the following mission areas:

Nuclear Survivability
High-Power Microwave Survivability and Source Technology
Electronic Fuzing and Smart Munitions
Radar Technology
ARM/CM
Information/Signal Processing

As agents for Program Executive Officers, Project Managers and Research, Development and Engineering Centers, HDL implements transfer of mission area technologies.

HDL MAJOR FIELDS OF TECHNICAL ENDEAVOR

U. S. ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

- Sensor Technology
- Signal Processing
- Information Processing & Sensor Fusion
- Fuze Applications
- Nuclear Survivability
- Radio Frequency Directed Energy Weapons Technology
- Producibility Technology

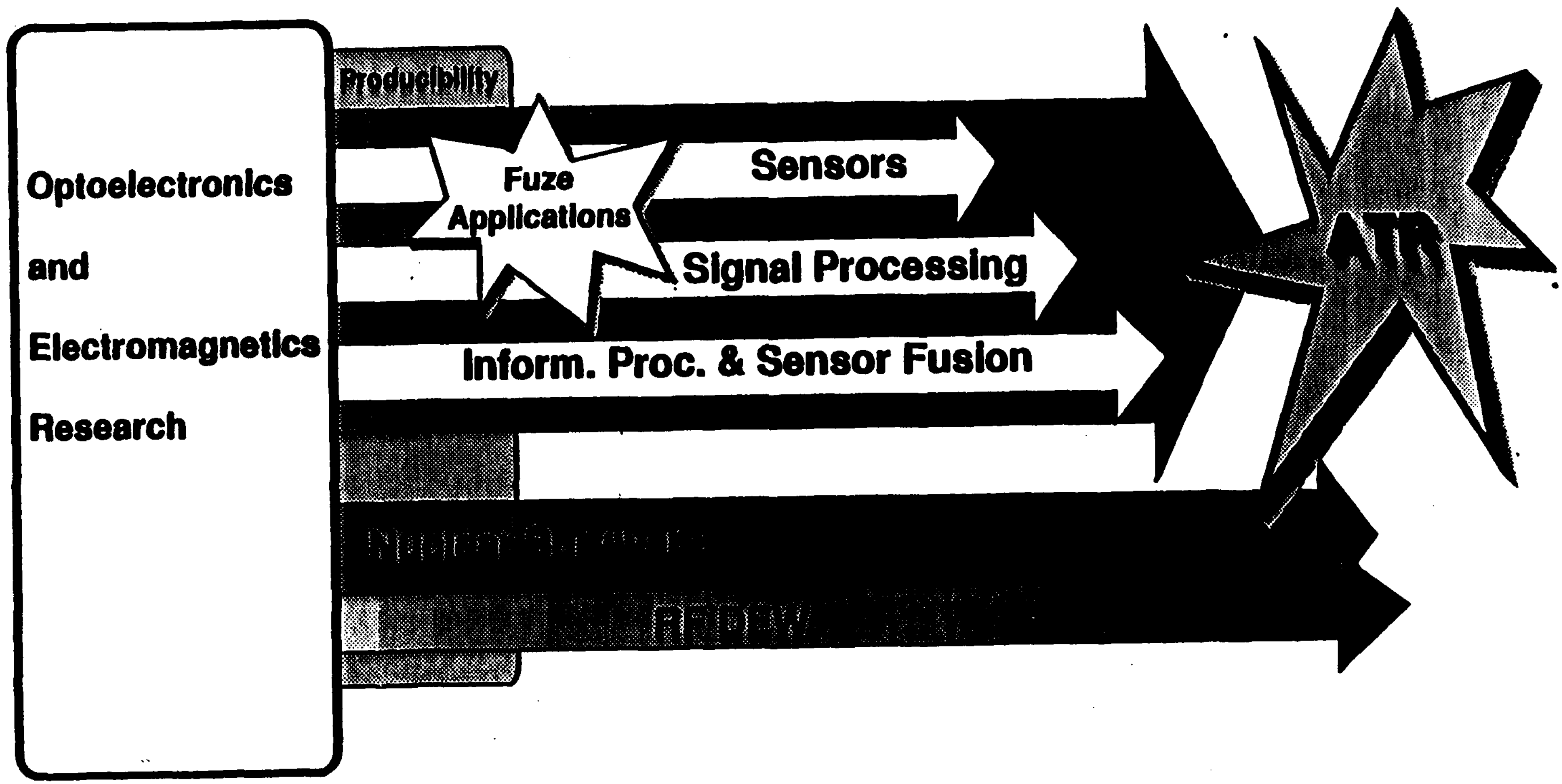
ACCOMPLISHMENTS

(LAST 5 YEARS)

U. S. ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

- Developed the Patriot fuze, Chaparral target detecting device, a nuclear artillery fuze, a mortar fuze, and the MLRS time fuze.
- Fuze technology (LSAA, electrostatics...)
- Created and demonstrated a combat information processor.
- Constructed and fielded two test bed acousto-optic based processing systems for wide band signal detection and analysis.
- Demonstrated MTI radar for UAV.
- Completed PIP for high altitude EMP protection.
- Developed hardened electrical/electronic shelters for nuclear survivable C3I tactical systems.
- Basic R&D for HPM (World's record for pulsed power)
- ARM/CM
- Signature simulations and modeling



HARRY DIAMOND LABORATORIES

Technology for the Future

SENSOR TECHNOLOGY THRUSTS

U. S. ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

- Guidance Integrated Fuzing
- Multi-static radar
- Wideband (impulse) radar
- Radar target models
- ARM-threat simulations

SIGNAL PROCESSING THRUSTS

U. S. ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

- High dynamic range optical signal processing
- Optoelectronics
- Neural nets

INFORMATION PROCESSING & SENSOR FUSION THRUSTS

U. S. ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

- Radar, electro-optical SIGINT, and other sensor information integration, with terrain knowledge
- Advanced multi-sensor fusion algorithm & expert systems
- Target acquisition theory

FUZE APPLICATION THRUSTS

U. S. ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

- XM450 Medium Altitude Proximity/Time MLRS Binary Chemical Fuze
- Multi-Option Fuze for Artillery (MOFA)

PRODUCIBILITY TECHNOLOGY THRUST

U. S. ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

- Near term emphasis on resolving soldering problems and establishing meaningful inspection criteria
- Broad interest in automated assembly of electronics
- Specific interest in novel assembly concepts and circuit assembly of future circuits such as photonic information processing systems

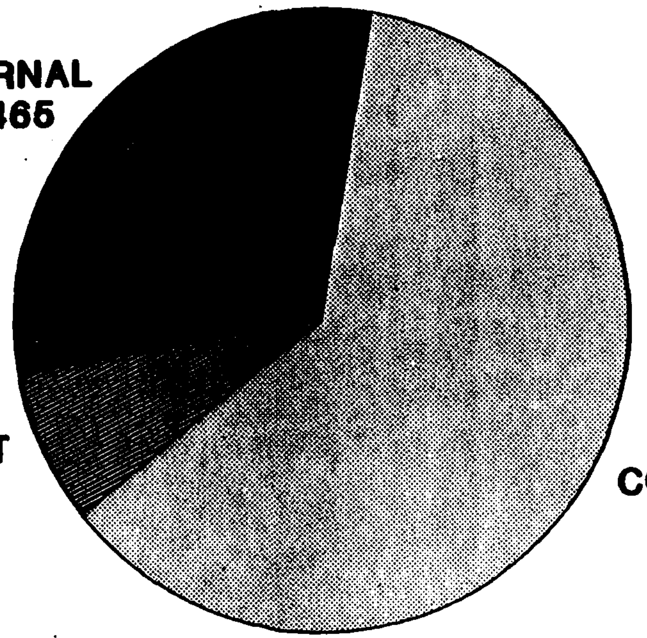
FUNDING PROFILE

FY 90

FY90 TOTAL OBLIGATIONS
($K)

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

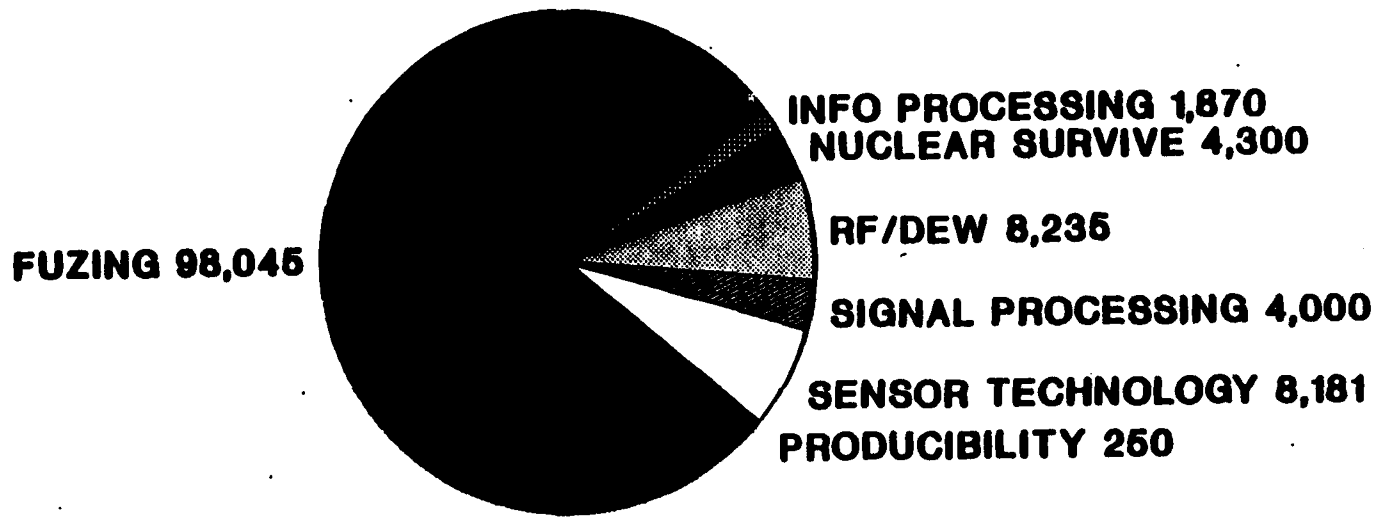


TOTAL: $202,471 K

HARRY DIAMOND LABORATORIES

US ARMY LABORATORY COMMAND

FY90 CONTRACT OBLIGATIONS
TOTAL ($K)

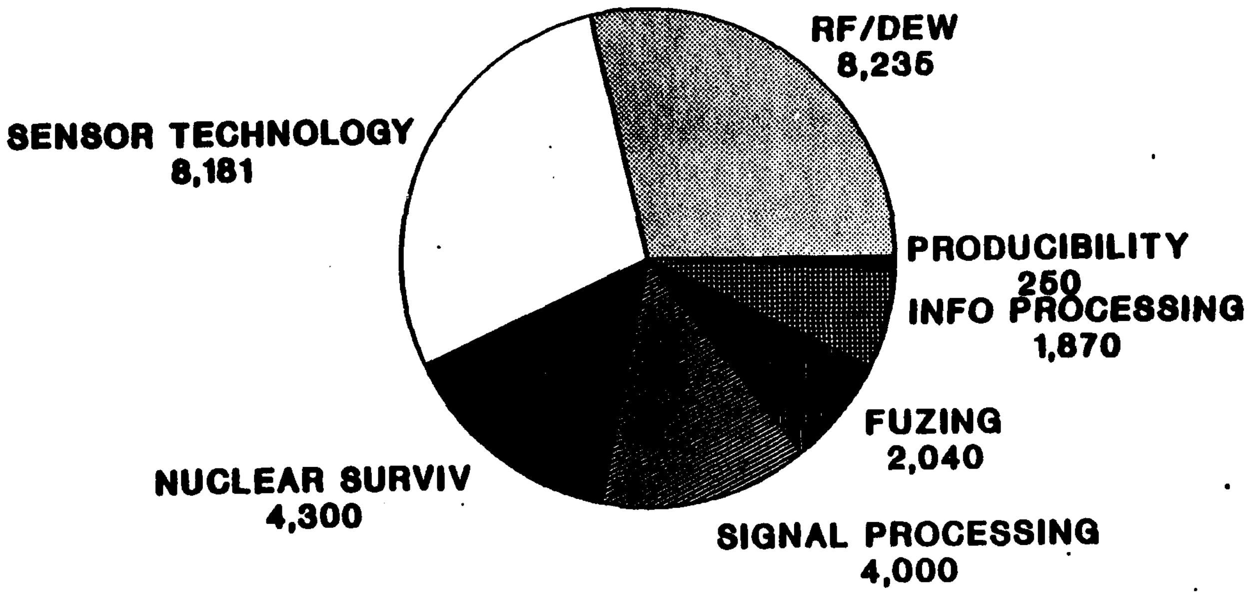


TOTAL: $124,881 K

FY90 CONTRACT OBLIGATIONS
($K)

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES



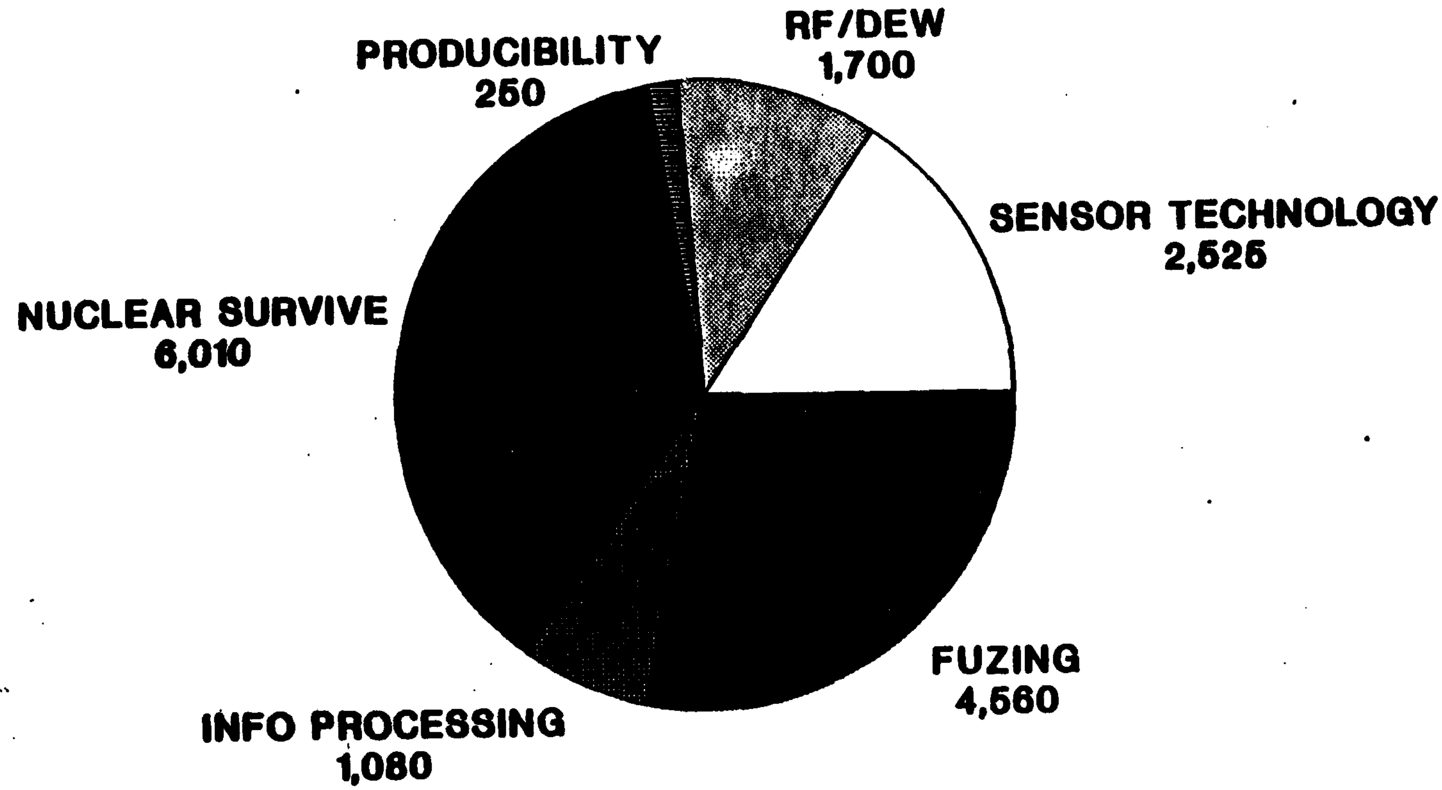
TOTAL: $28,876 K

EXCLUDES $96,005 K FUZE PRODUCTION

FY90 SUPPLIES/EQUIPMENT
($K)

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

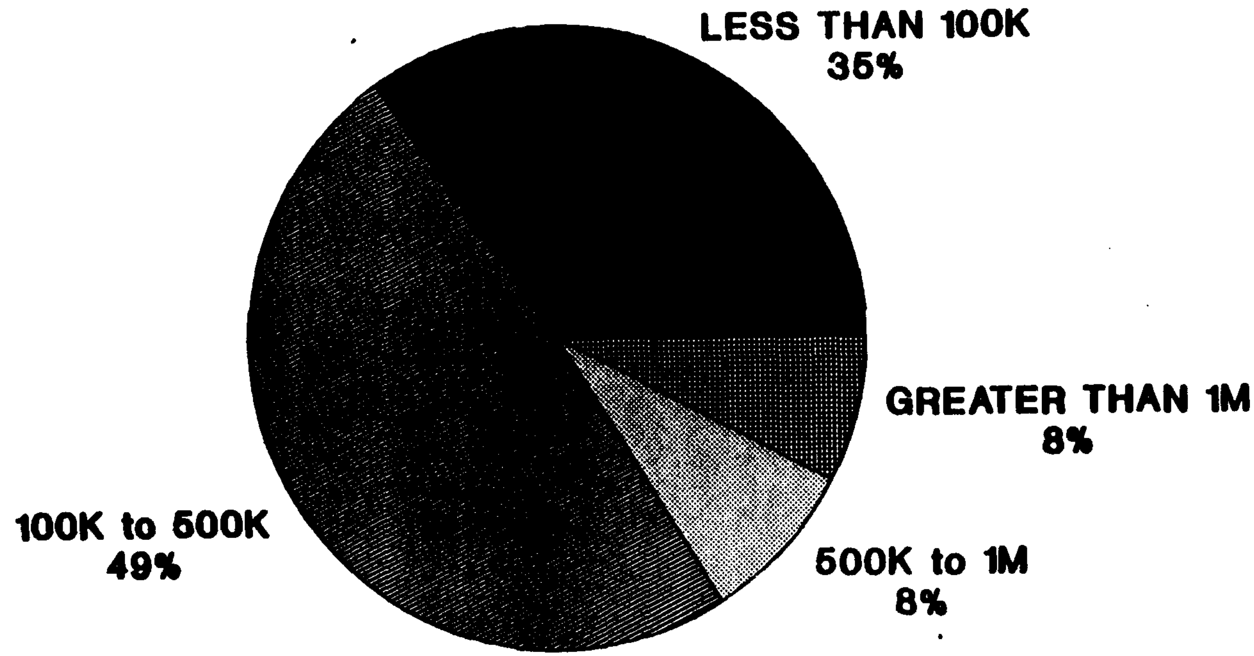


TOTAL: $16,125 K

FY90 CONTRACT PLAN

HARRY DIAMOND LABORATORIES

US ARMY LABORATORY COMMAND

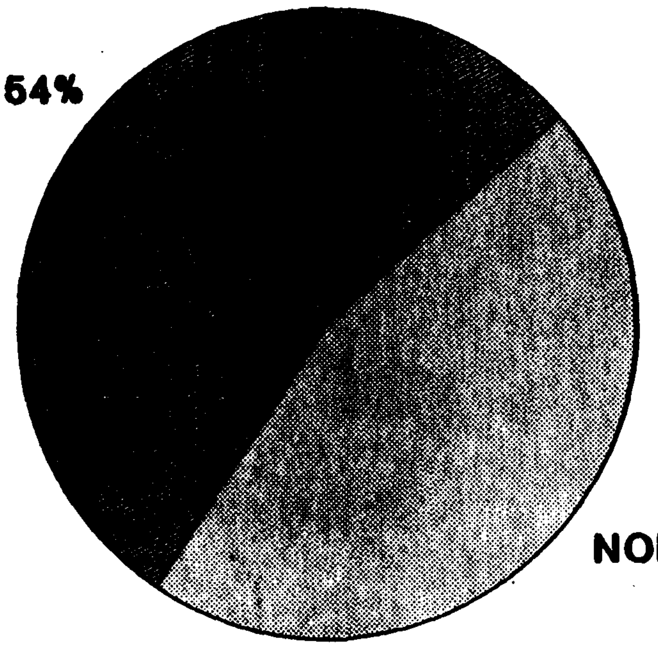


ACTIONS (273 TOTAL)

FY90 COMPETITIVE ACTIONS
($K)

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

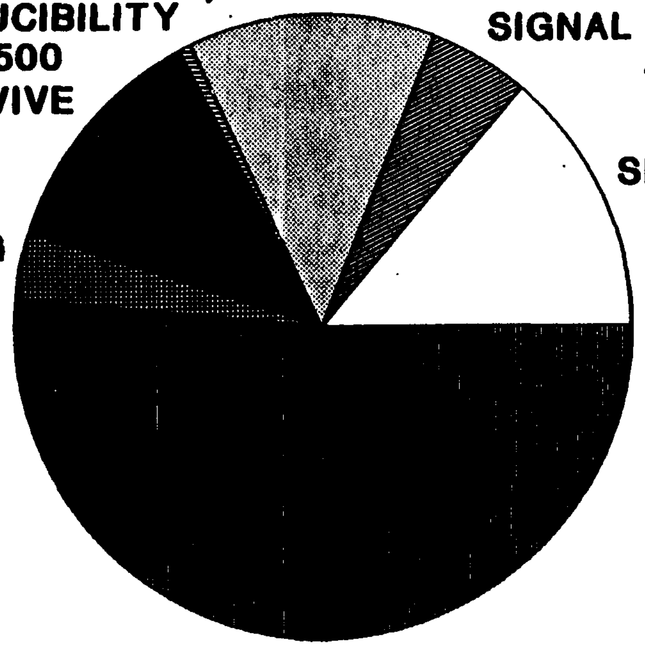


TOTAL: $141,006 K

HARRY DIAMOND LABORATORIES

FY90 COMPETITIVE ACTIONS
($K)

US ARMY
LABORATORY COMMAND



TOTAL: $76,515 K

HARRY DIAMOND LABORATORIES

US ARMY LABORATORY COMMAND

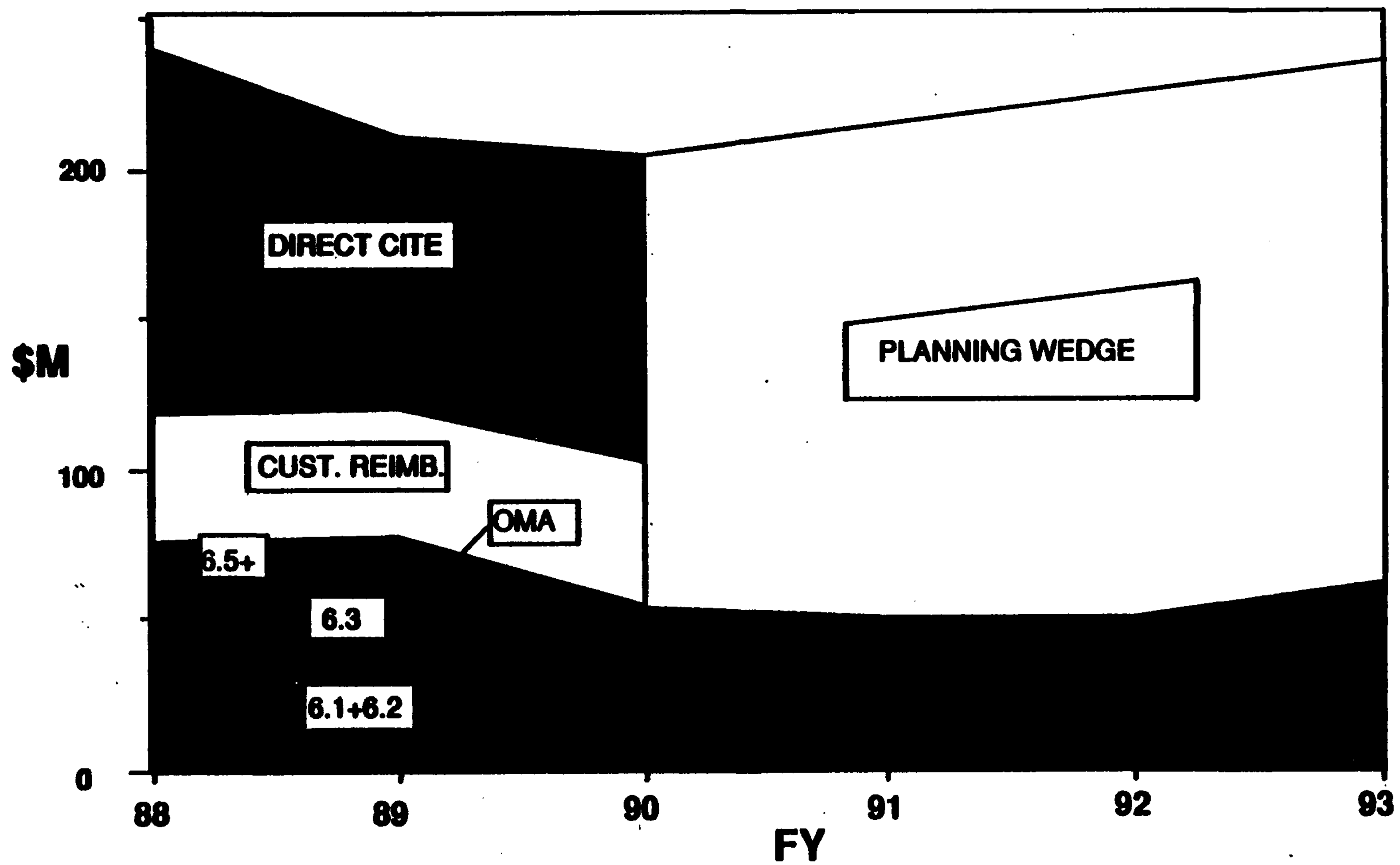
SERVICE CONTRACTS
(APPROX $20 M PER YEAR)

FY	IN EFFECT	NEW	EXPIRING
90	15	6	7
91	14	4	2
92	16	4	4
93	16	2	0
94	18	2	0

HDL FUNDING

U. S. ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES



SUMMARY

- HDL anticipates stable R&D funding for the future.

- Many business opportunities exist in several diverse technical areas.

- HDL advocates development of Government - Industry - Academia partnerships.

ACCOMPLISHMENTS
(LAST 5 YEARS)

U. S. ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

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- Completed PIP for high altitude EMP protection.
- Developed hardened electrical/electronic shelters for nuclear survivable C3I tactical systems.
- Basic R&D for HPM (World's record for pulsed power)
- ARM/CM
- Signature simulations and modeling

USER REQUIREMENTS

23 JANUARY 1990

ADVANCED PLANNING BRIEFING FOR INDUSTRY

LABCOM & HARRY DIAMOND LABS

JAMES F. FOX
COMBINED ARMS CENTER
ATZL-SCI
FT. LEAVENWORTH, KS 66027
AV 552-2962
COMM 913-684-2962

TOPICS

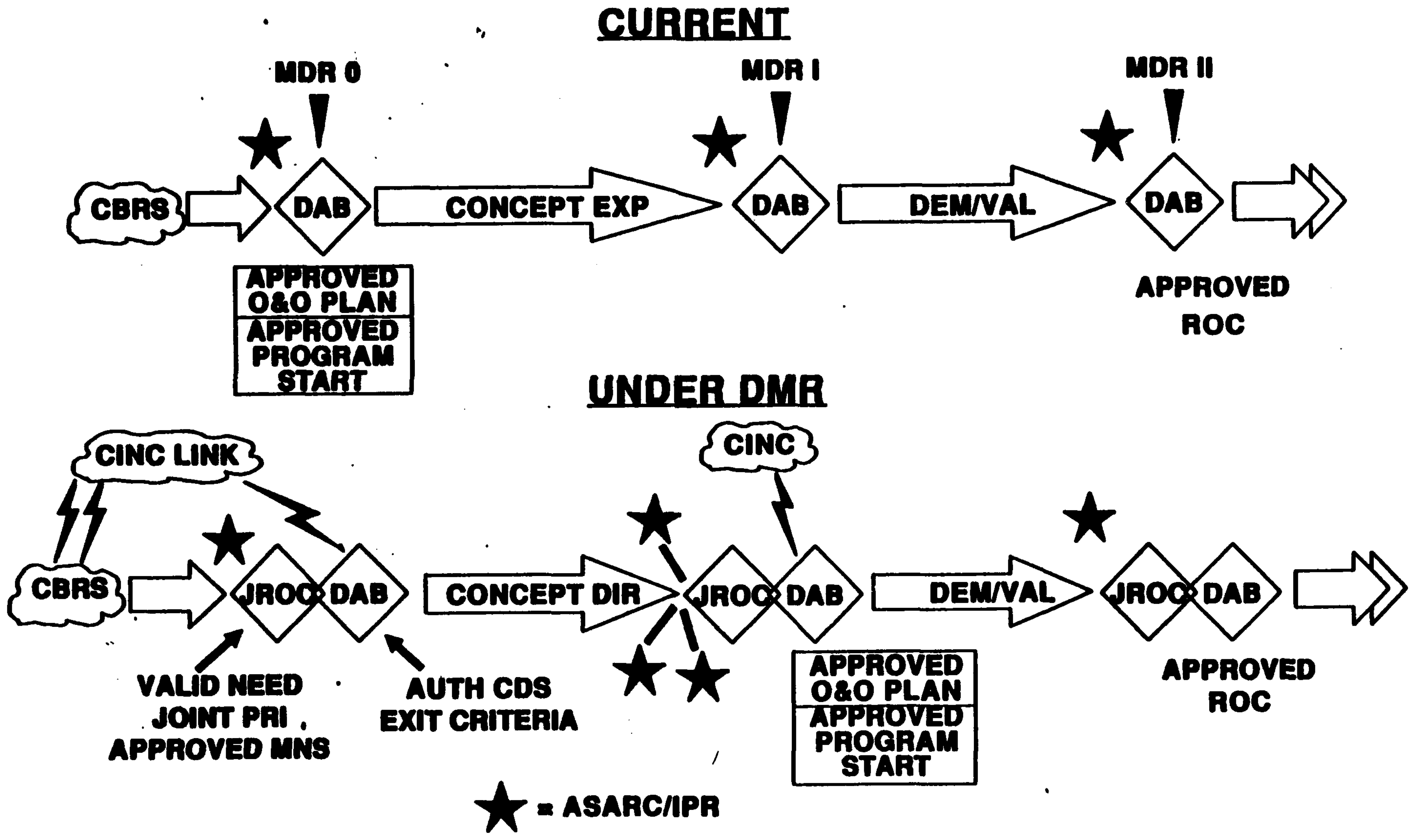
SPEAKER IDENTIFICATION

NEW CD PROCESS

OTHER INITIATIVES

EXAMPLE REQUIREMENTS

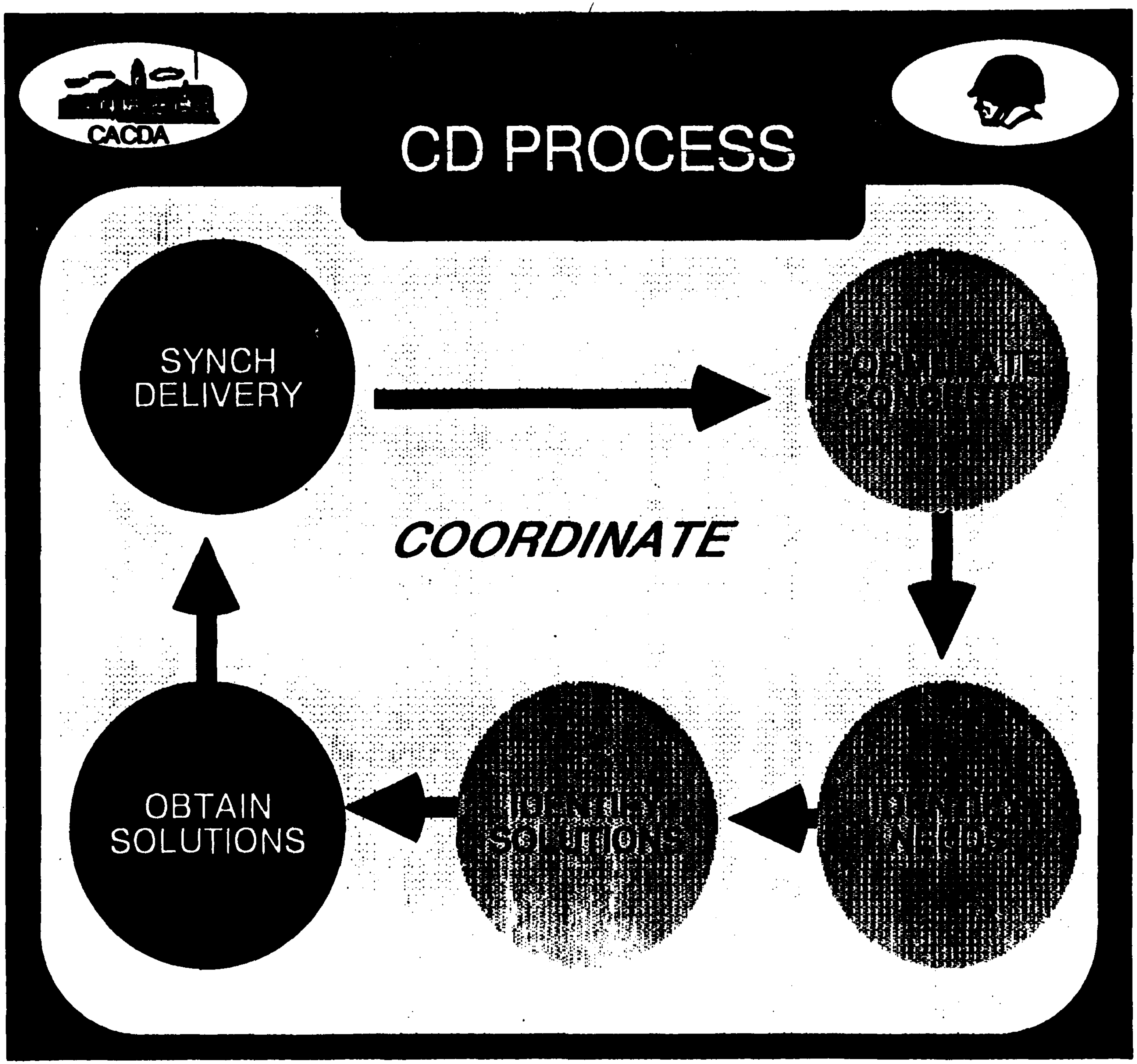
ACQUISITION PROCESS



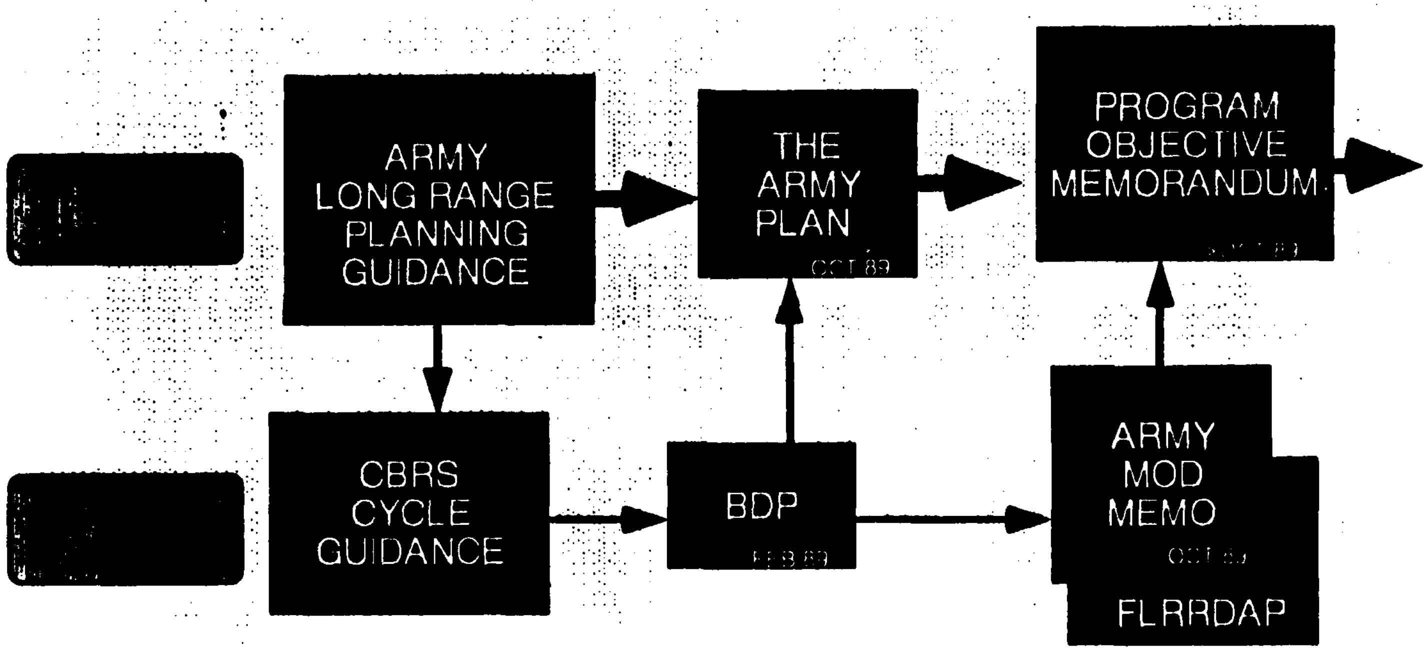
ACC/MACOM LINK

REVISE OUR TRADITIONAL APPROACH TO CBRS BY PROVIDING CONDUIT TO ARMY COMPONENT COMMANDERS (ACC) AND MACOM COMMANDERS

- WORK WITH ACCs/MACOMs TO OBTAIN ARMY REQUIREMENTS
- INTEGRATE INPUT INTO CBRS
- COORDINATE CBRS PRODUCTS WITH ACCs/MACOMs

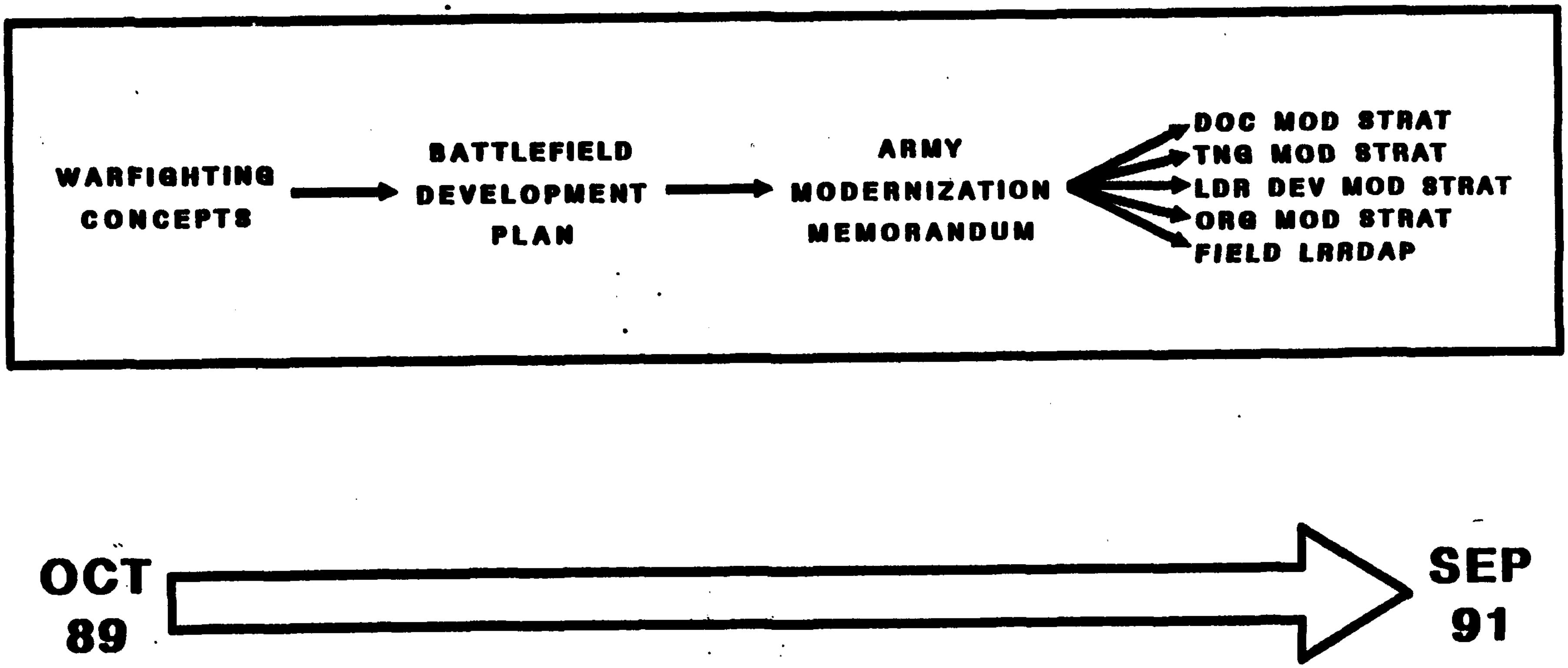

CACDA
CD PROCESS
SYNCH DELIVERY
COORDINATE
OBTAIN SOLUTIONS

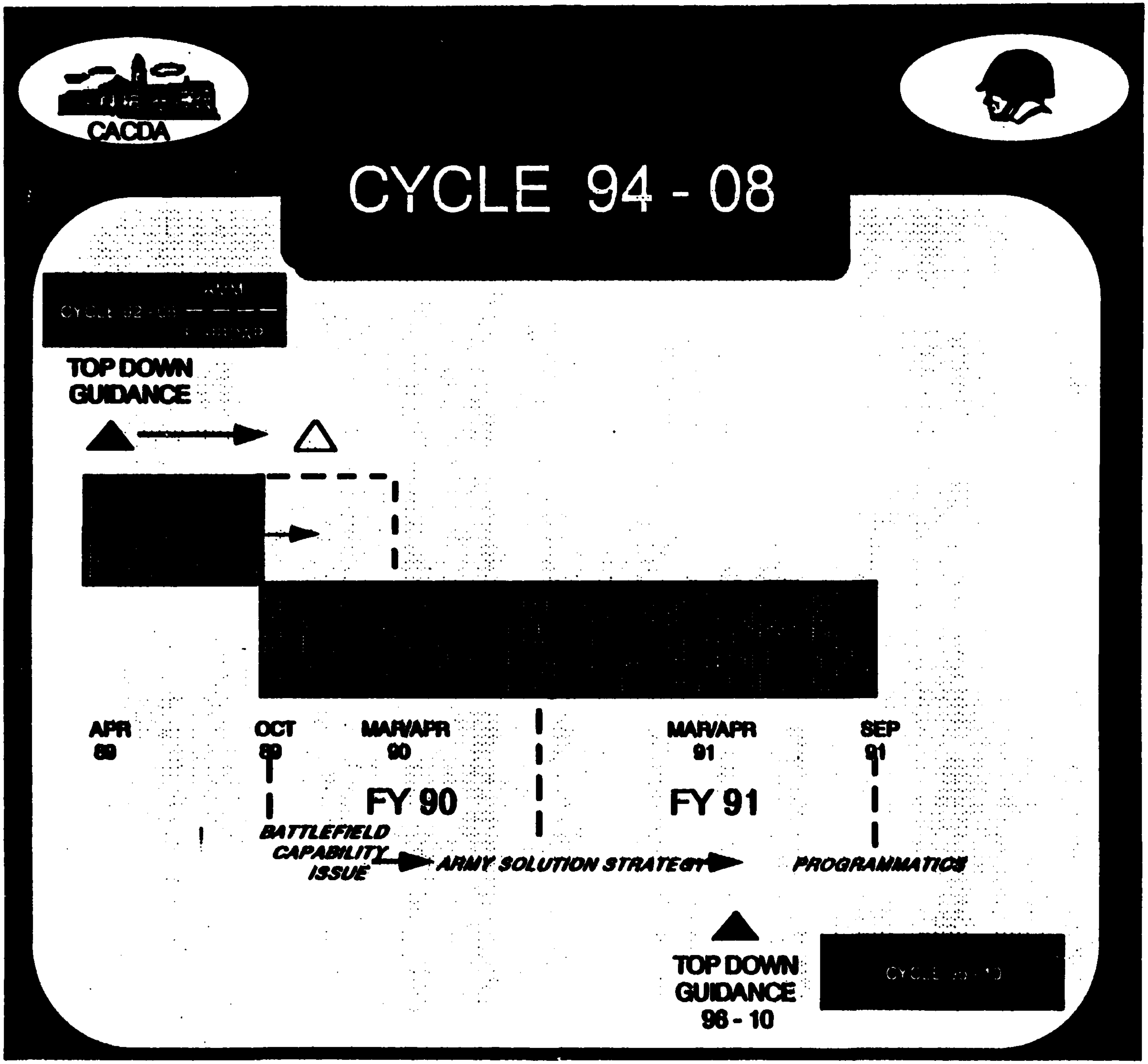
PLANNING PROCESS



- PLANNING, PROGRAMMING, BUDGETING, AND EXECUTION SYSTEM

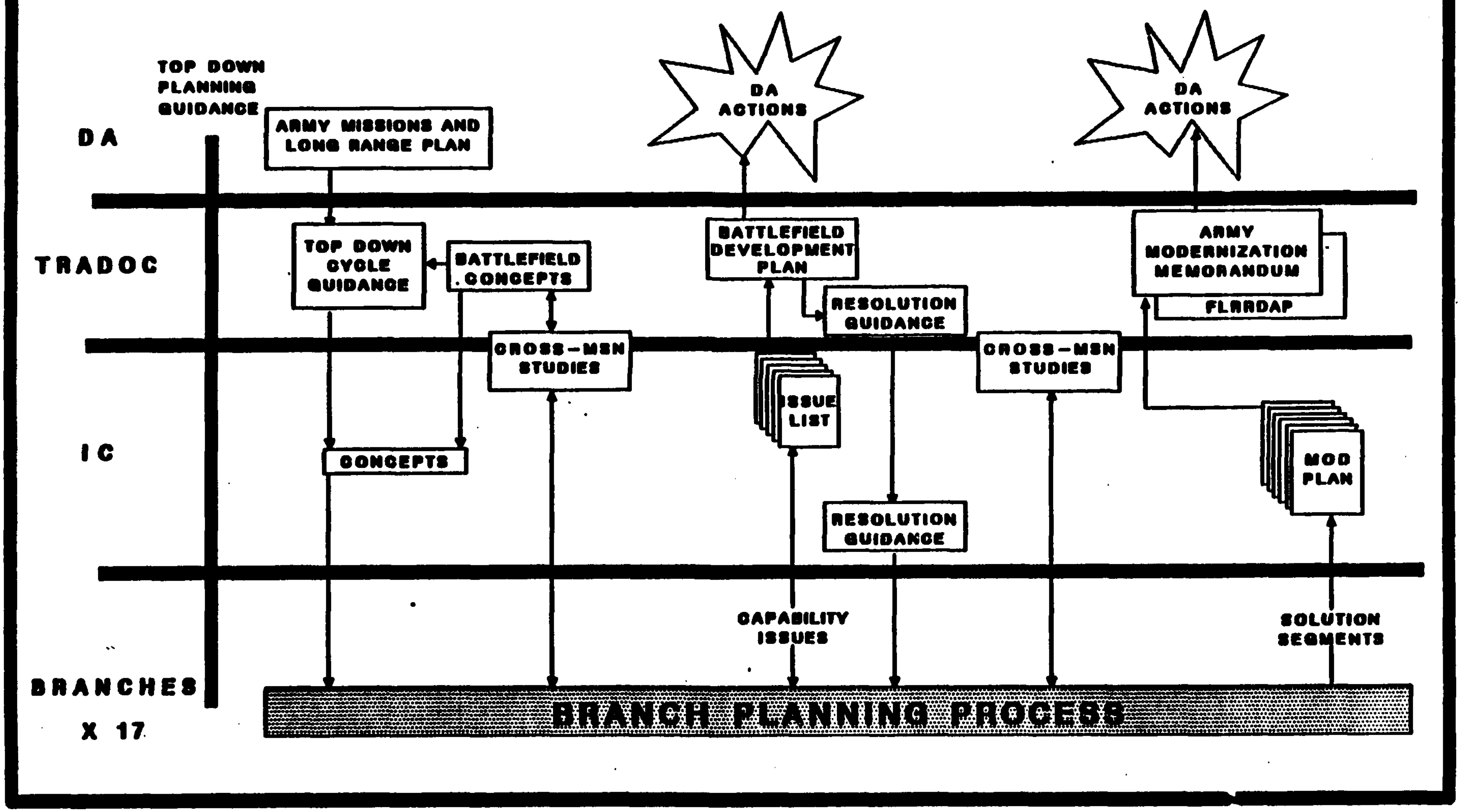
CAC CBRS RESPONSIBILITIES

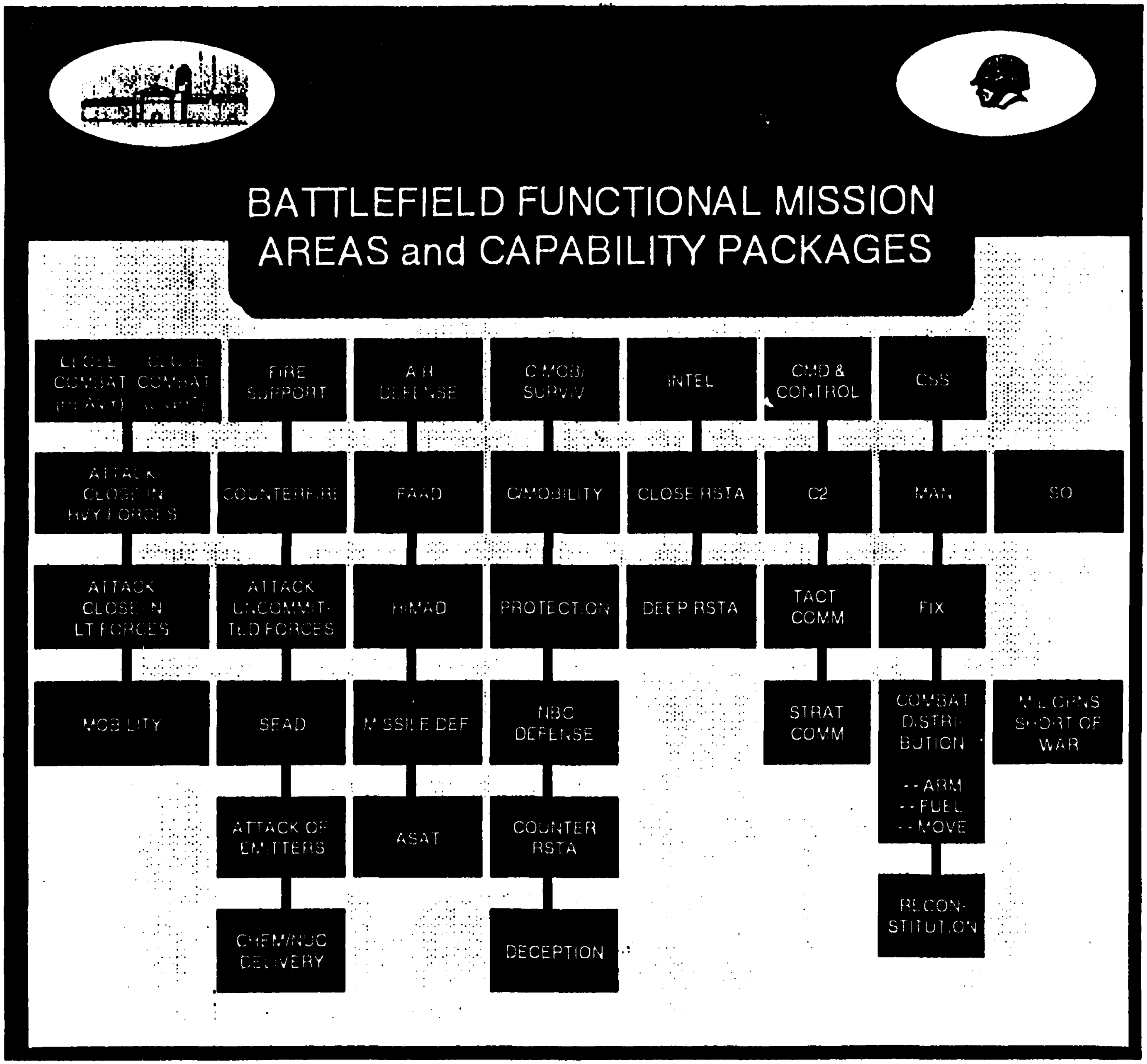




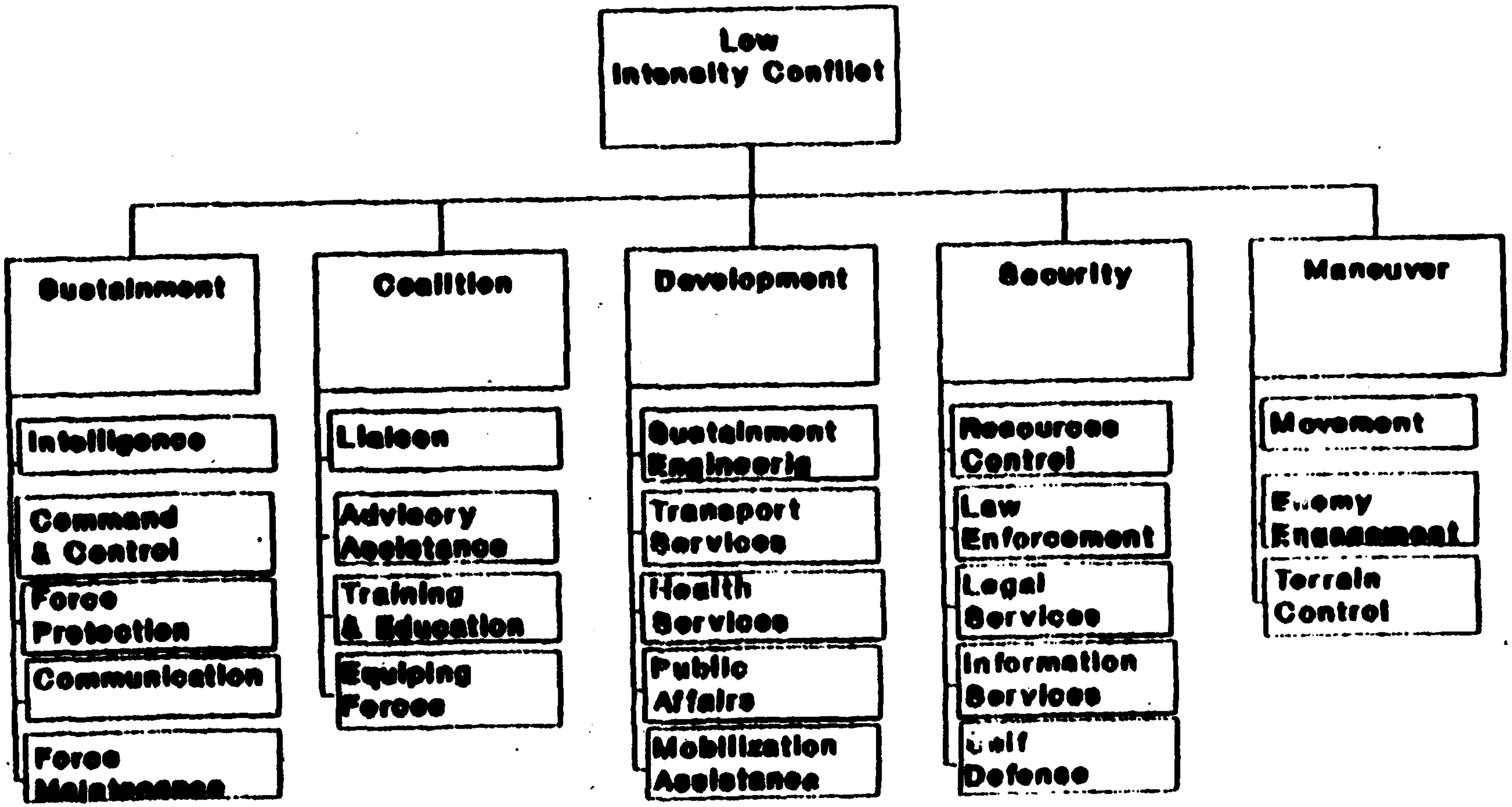
CACDA
CYCLE 94 - 08
TOP DOWN
GUIDANCE
APR
89
OCT
89
MAR/APR
90
FY 90
MAR/APR
91
FY 91
SEP
91
BATTLEFIELD
CAPABILITY
ISSUE
ARMY SOLUTION STRATEGY
PROGRAMMATICS
TOP DOWN
GUIDANCE
96 - 10

MODERNIZED CBRS




BATTLEFIELD FUNCTIONAL MISSION
AREAS and CAPABILITY PACKAGES
CLOSE COMBAT (HEAVY)
CLOSE COMBAT (LIGHT)
FIRE SUPPORT
AIR DEFENSE
C MOB/ SURVIV
INTEL
CMD & CONTROL
CSS
ATTACK CLOSE IN HVY FORCES
COUNTERFIRE
FAAD
C/MOBILITY
CLOSE RSTA
C2
MAN
SO
ATTACK CLOSE IN LT FORCES
ATTACK UNCOMMIT-TED FORCES
HIMAD
PROTECTION
DEEP RSTA
TACT COMM
FIX
MOBILITY
SEAD
MISSILE DEF
NBC DEFENSE
STRAT COMM
COMBAT DISTRI-BUTION
-- ARM
-- FUEL
-- MOVE
MIL OPNS SHORT OF WAR
ATTACK OF EMITTERS
ASAT
COUNTER RSTA
RECON-STITUTION
CHEM/NUC DELIVERY
DECEPTION

LIC OPERATING SYSTEMS
(LOS)



POTENTIAL TECHNOLOGY APPLICATIONS IN LIC

DISCRIMINATE WEAPONS SYSTEMS

MINIATURIZED EXPLOSIVES & NARCOTICS DETECTION EQUIPMENT

SMART ELECTRONIC CARDS FOR PERSONAL IDENTIFICATION

X-RAY MACHINES FOR NON-METALLIC OBJECTS

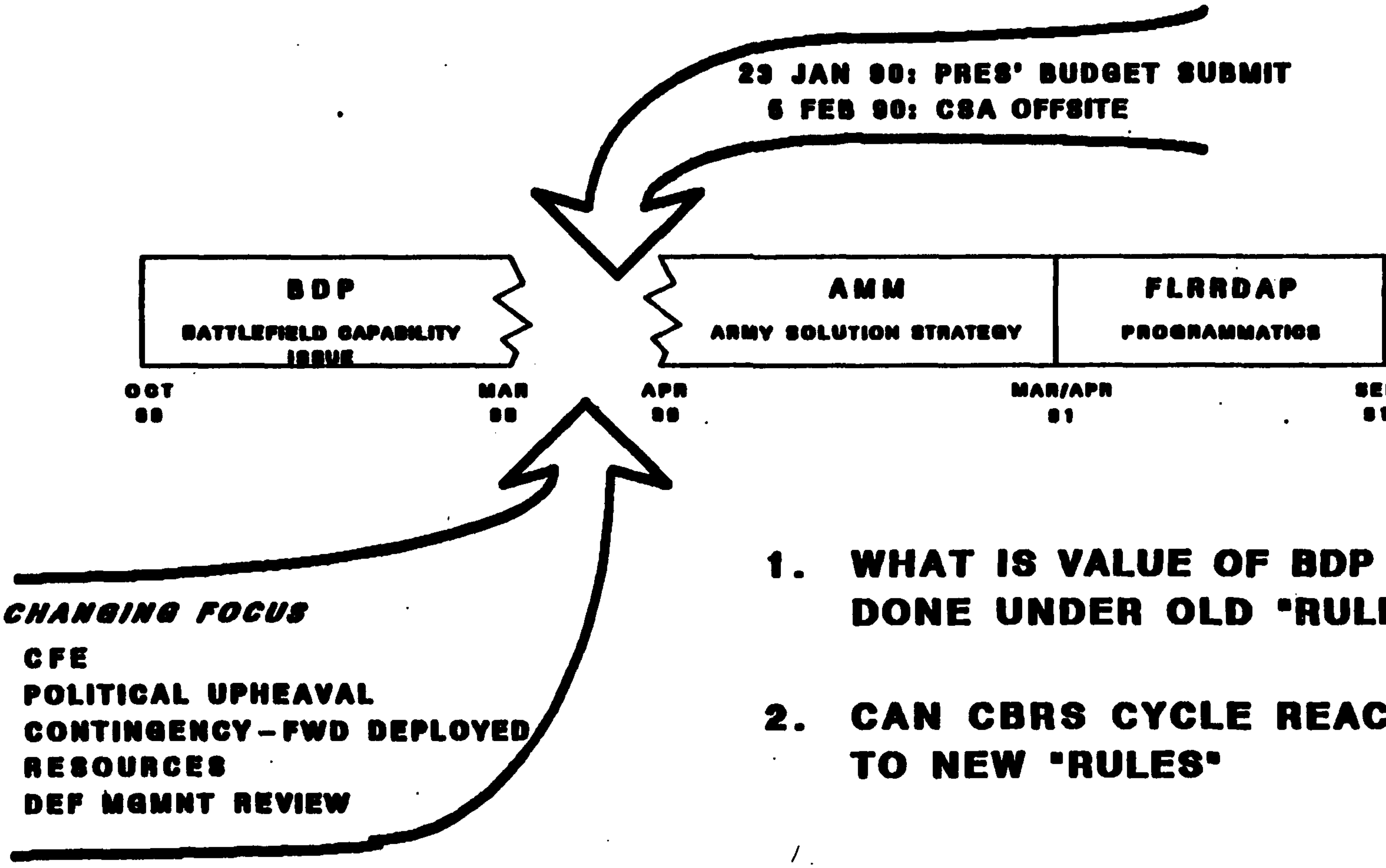
CULTURAL-SPECIFIC PACKAGED RATIONS

COMPUTER SIMULATIONS FOR MISSION REHEARSALS

LOW-COST, EFFECTIVE NIGHT VISION EQUIPMENT

LOW-COST, SIMPLE COUNTERMINE EQUIPMENT

PROBLEM



1. WHAT IS VALUE OF BDP DONE UNDER OLD "RULES"

2. CAN CBRS CYCLE REACT TO NEW "RULES"

TRENDS

CONFLICTS

- ↓ NUCLEAR
- ↓ GLOBAL – HIGH INTENSITY
- ↑ REGIONAL
- ↑ LOW INTENSITY

RESOURCES

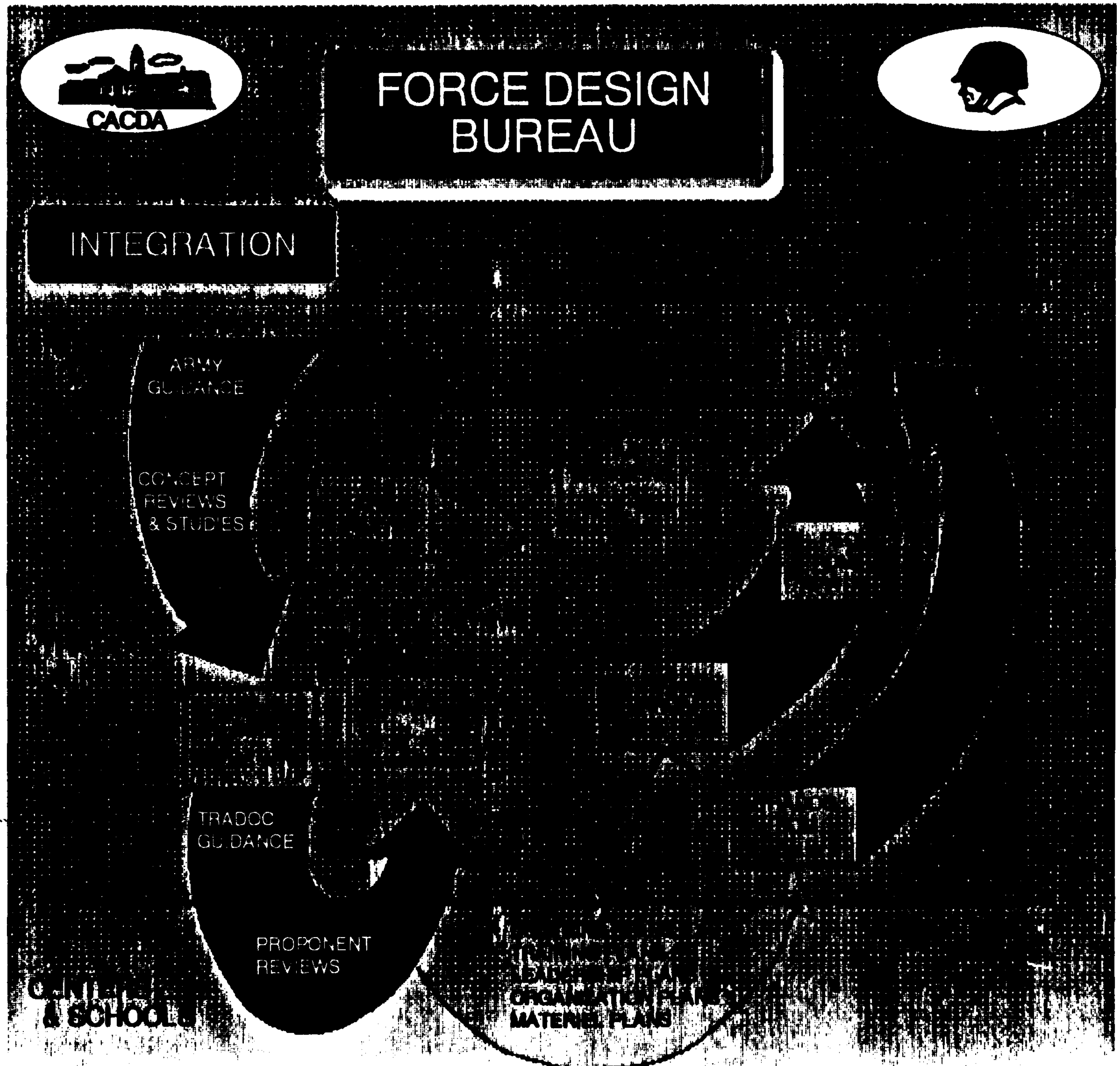
- ↓ BUDGETS
- ↓ DEMOGRAPHICS
- ↓ FORCE STRUCTURE

FORCES

- ↓ FORWARD DEPLOYED
- ↑ CONTINGENCY
- ↑ SPEC MSN/NATION DEVELOP

WEAPONS

- ↑ COST
- ↓ NUMBERS
- ↑ COMPLEXITY
- ↑ SENSOR CAPABILITY
- ↑ LETHALITY/RANGE/ACCURACY


FORCE DESIGN
BUREAU
CACDA
INTEGRATION
ARMY
GUIDANCE
CONCEPT
REVIEWS
& STUDIES
TRADOC
GUIDANCE
PROPONENT
REVIEWS
& SCHOOLS
MATERIEL PLANS


FORCE DESIGN
BUREAU
CURRENT FORCES DIRECTORATE
TRENDS
• MORE MOBILITY • INDEPENDENT OPERATIONS

CACDA

FORCE DESIGN BUREAU

ALB-F DESIGN FEATURES

ENDURANCE

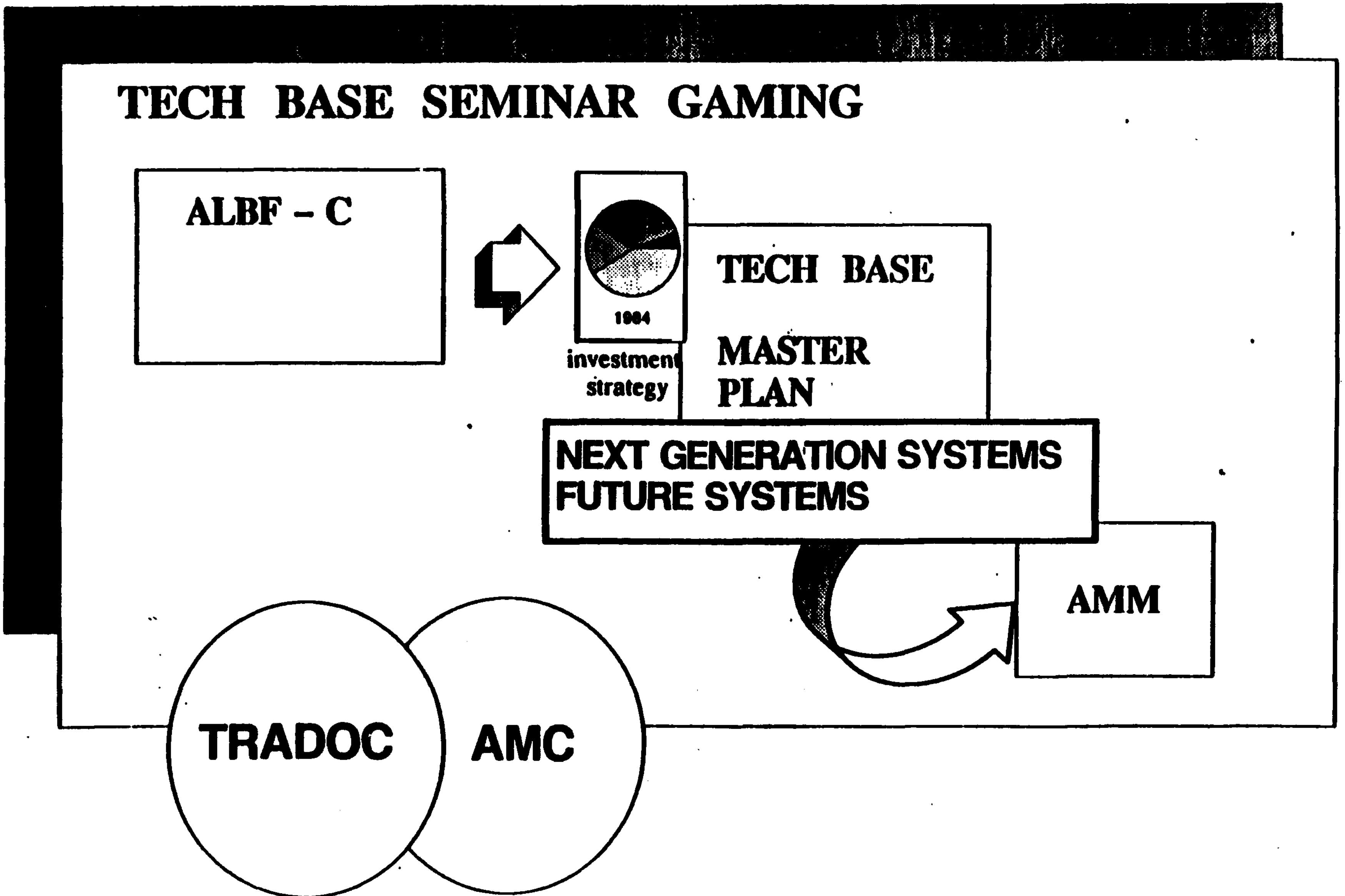
CACDA

CURRENT FORCES DIRECTORATE

EXAMPLES

- LTWT COUNTER OBSTACLE SYSTEM
- LTWT CHEMICAL SYSTEMS
- BACKPACK UAV
- A TRUE LIGHT TANK
- LTWT POWER GENERATION

OBJECTIVE : LEVERAGE TECHNOLOGY FOR WINNING --



TECH BASE INVESTMENT STRATEGY REVIEW

PHASES I & II : Tech Base Investment Strategy Conf '90

ESTABLISH SETTING – 2010

- GEOPOLITICAL BRIEF
- REGIONAL BRIEFS
- ALBF – CONCEPT
- CONTINGENCY FORCE PKG
- THREAT BRIEFS

TRADOC AMC

EQUIP THE FORCE

PHASE I :

CONCEPT OF NGS/FS APPLICATIONS

- NGS/FS SOURCE BOOK
- SEMINAR DISCUSSIONS
  - TECHNOLOGISTS
  - TACTICIANS

PHASE II :

BUY NGS/FS

- PROMISING NGS/FS
- COST CONSTRAINED
- R&D, ACQ, O&S

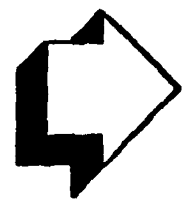
TECH BASE INVESTMENT STRATEGY REVIEW

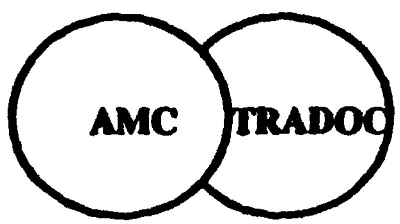
PHASE III : Tech Base Seminar Game II

EVALUATE THE FORCE

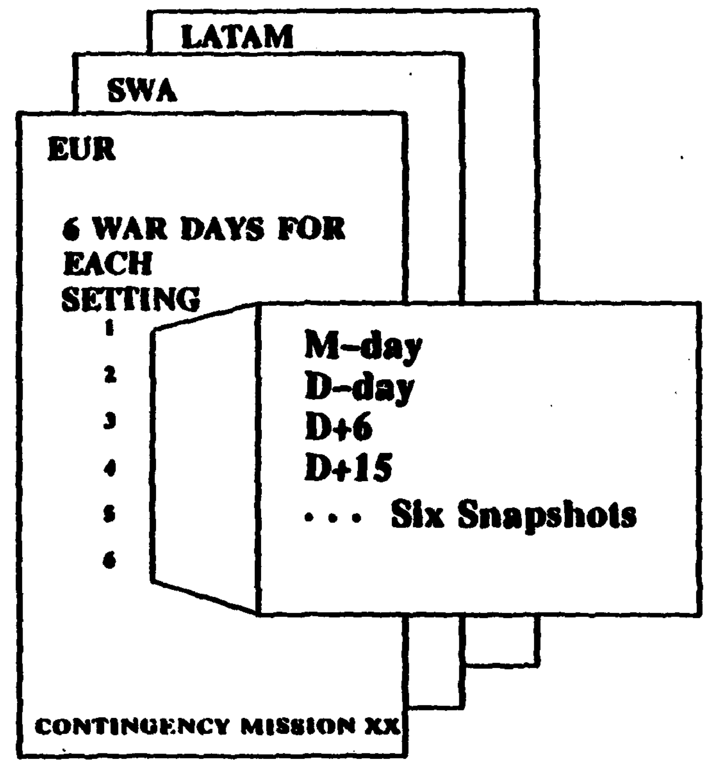
SEMINAR GAMING

- SELECTED NGS/FS
- SEMINAR DISCUSSIONS
  - TECHNOLOGISTS
  - TACTICIANS
- COMPUTER ASISTED





3 REGIONAL SETTINGS



US AP Forecast II

US ARMY MATERIEL COMMAND
OFFICE OF THE CHIEF SCIENTIST

NATIONAL ACADEMY OF SCIENCE
BOARD ON ARMY SCIENCE & TECHNOLOGY (BAST)
STRATEGIC TECHNOLOGY FOR THE ARMY (STAR) STUDY

OBJECTIVE

RECOGNIZE NOW HIGH-PAYOFF TECHNOLOGIES THAT CAN:

- BE INSERTED INTO 21st CENTURY ARMY EQUIPMENT & DOCTRINE
- YIELD GREATLY IMPROVED WARFIGHTING CAPABILITY

AMC

US ARMY MATERIEL COMMAND
OFFICE OF THE CHIEF SCIENTIST

STRATEGIC TECHNOLOGIES FOR THE ARMY (STAR) STUDY SCOPE

- DURATION: TWO YEARS
- MANYEARS OF EFFORT REQUIRED:
  - 150 PER YEAR FOR BAST MEMBERS
  - 150 PER YEAR FROM ARMY (ASA, AMC, TRADOC, COE, MRDC, ARI, SDC, SOCOM)
- BAST PRINCIPALS:
  - DR MARTIN A. GOLAND, BAST CHAIRMAN
  - DR WILLIS HAWKINS, STUDY CHAIRMAN
  - MR. RAY L. LEADABRAND, INTEGRATION SUBCOMMITTEE
  - MR. MICHAEL D. RICH, TECH MGMT & DEV PLANNING SUBCOMMITTEE
  - MR. ROBERT R. EVERETT, SCIENCE & TECHNOLOGY SUBCOMMITTEE

AMC

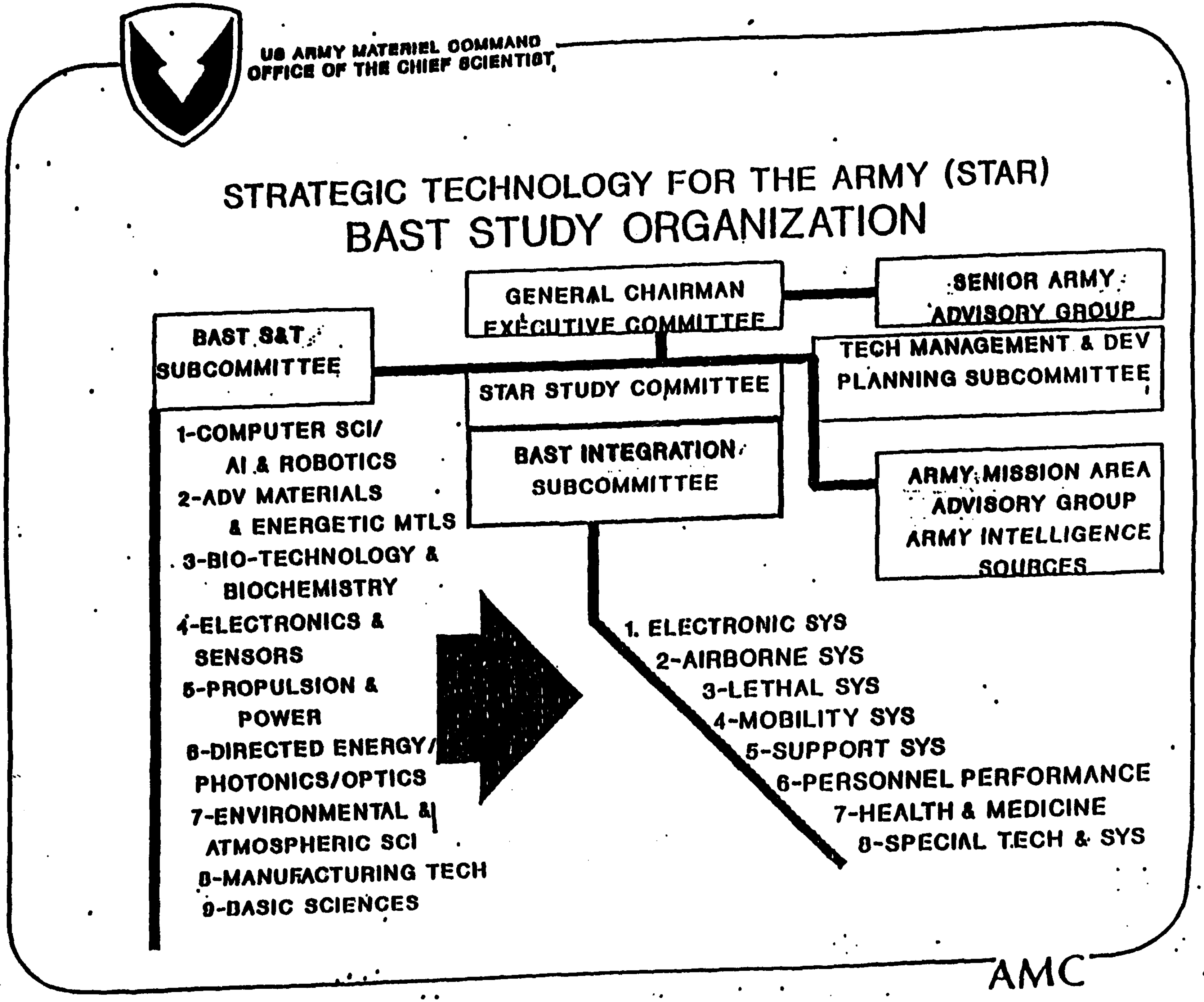
US ARMY MATERIEL COMMAND
OFFICE OF THE CHIEF SCIENTIST

STRATEGIC TECHNOLOGY FOR THE ARMY (STAR) STUDY

APPROACH

- IDENTIFY THE ADVANCED TECHNOLOGY MOST LIKELY TO BE IMPORTANT IN GROUND WARFARE IN THE 21ST CENTURY
- OFFER TECHNOLOGY STRATEGIES THAT THE ARMY SHOULD CONSIDER IN DEVELOPING THEIR FULL POTENTIAL
- SUGGEST, WHERE POSSIBLE, THE IMPLICATIONS FOR FORCE STRUCTURE MODERNIZATION AND STRATEGY

AMC


US ARMY MATERIEL COMMAND
OFFICE OF THE CHIEF SCIENTIST
STRATEGIC TECHNOLOGY FOR THE ARMY (STAR)
BAST STUDY ORGANIZATION
GENERAL CHAIRMAN EXECUTIVE COMMITTEE
SENIOR ARMY ADVISORY GROUP
BAST S&T SUBCOMMITTEE
STAR STUDY COMMITTEE
TECH MANAGEMENT & DEV PLANNING SUBCOMMITTEE
BAST INTEGRATION SUBCOMMITTEE
ARMY MISSION AREA ADVISORY GROUP ARMY INTELLIGENCE SOURCES
1-COMPUTER SCI/ AI & ROBOTICS
2-ADV MATERIALS & ENERGETIC MTLS
3-BIO-TECHNOLOGY & BIOCHEMISTRY
4-ELECTRONICS & SENSORS
5-PROPULSION & POWER
6-DIRECTED ENERGY/ PHOTONICS/OPTICS
7-ENVIRONMENTAL & ATMOSPHERIC SCI
8-MANUFACTURING TECH
9-BASIC SCIENCES
1. ELECTRONIC SYS
2-AIRBORNE SYS
3-LETHAL SYS
4-MOBILITY SYS
5-SUPPORT SYS
6-PERSONNEL PERFORMANCE
7-HEALTH & MEDICINE
8-SPECIAL TECH & SYS
AMC

CURRENT STATUS

ARMY

- APPROVED DIRECTED ENERGY MASTER PLAN
- RF CONCEPTS
  - ATACM RF MUNITION AND LOITERING RF DRONE
  - COUNTERMINE - RF DEVICE
  - AREA DENIAL - RF MINE
  - PROXIMITY FUZE/SENSOR JAMMER
  - COMBAT VEHICLE/AIRCRAFT PROTECTION
  - RF AIR DEFENSE SYSTEM

AIR FORCE/NAVY

- DRAFT DIRECTED ENERGY MASTER PLANS
- OPERATIONAL CONCEPTS NOT YET IDENTIFIED

"DEWING THE DEWABLE"
— — SURVIVABILITY — —

RADIO FREQUENCY

NEAR TERM

- IDENTIFY VULNERABILITIES
- RF HARDEN EQUIPMENT
- PLAN FOR ADDITIONAL PROTECT

MID TERM

- DEV HARDER, CHEAP MICROCIRCUITS
- DEV ALT FOR SOFT COMPONENTS

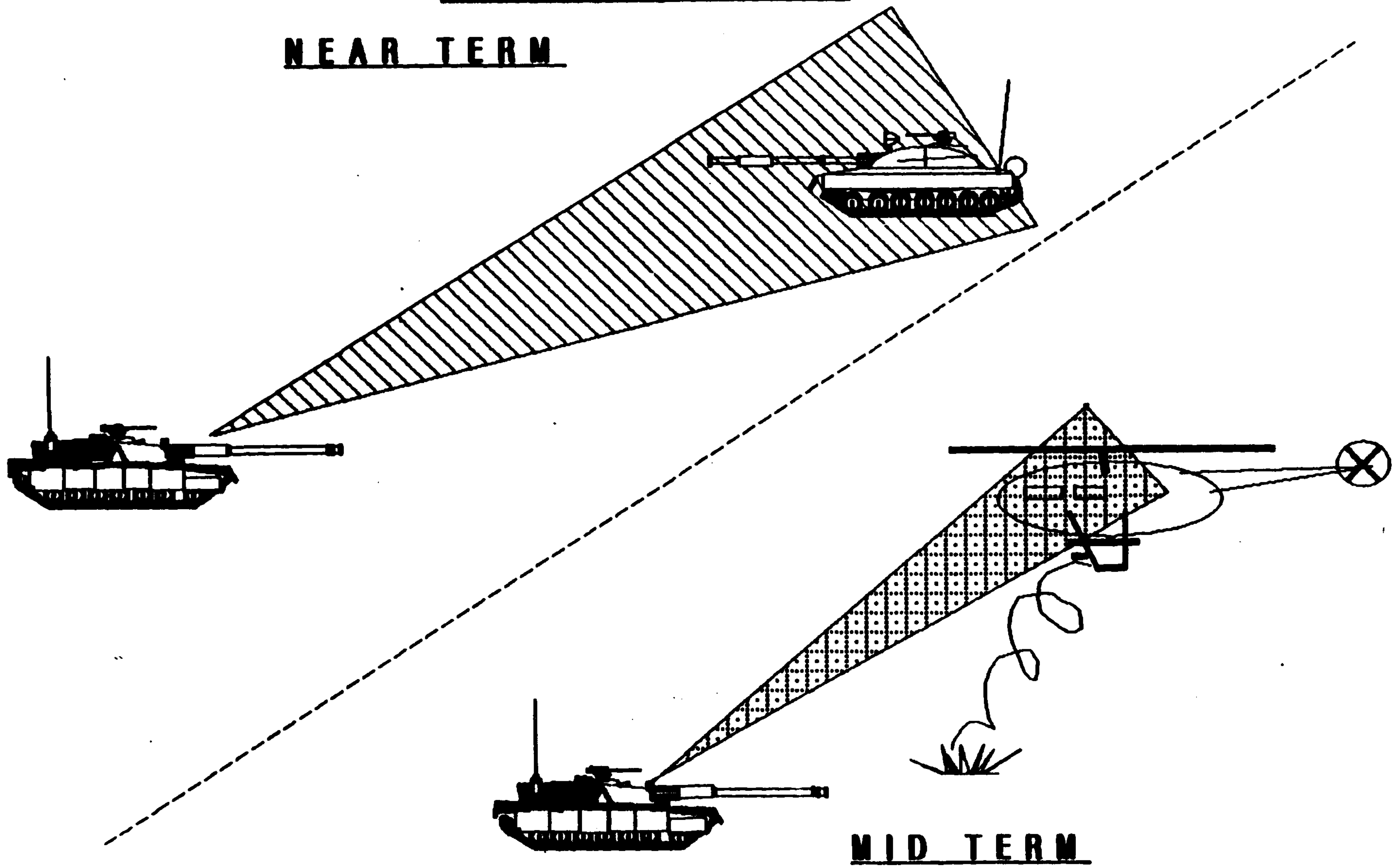
CONCEPT

- DEFEAT
- DESTROY
- DISRUPT

ENEMY COMBAT POWER USING EM RADIATION
(CONCERT WITH C/A TEAM)

RF MISSION

RF COMBAT



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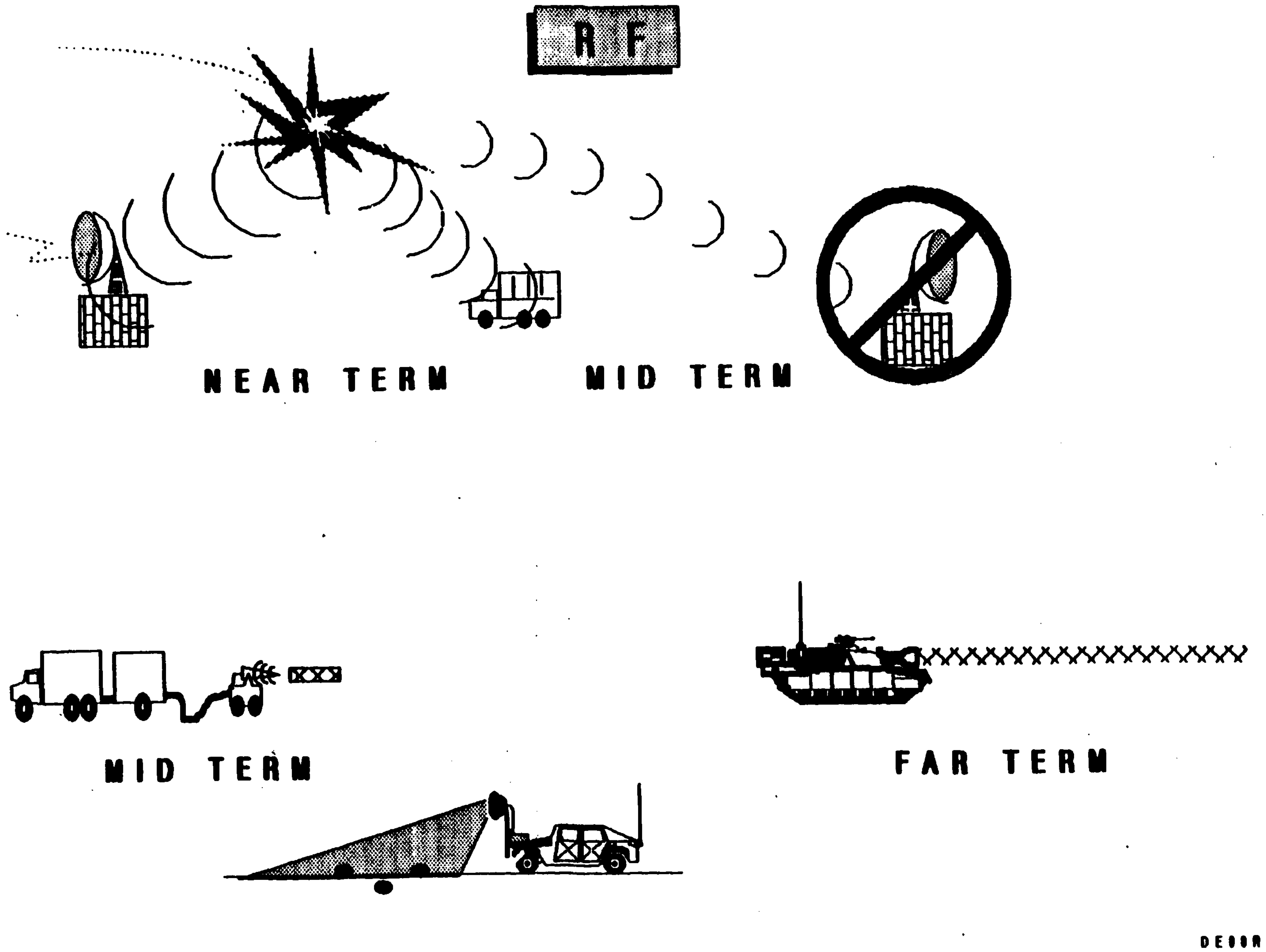
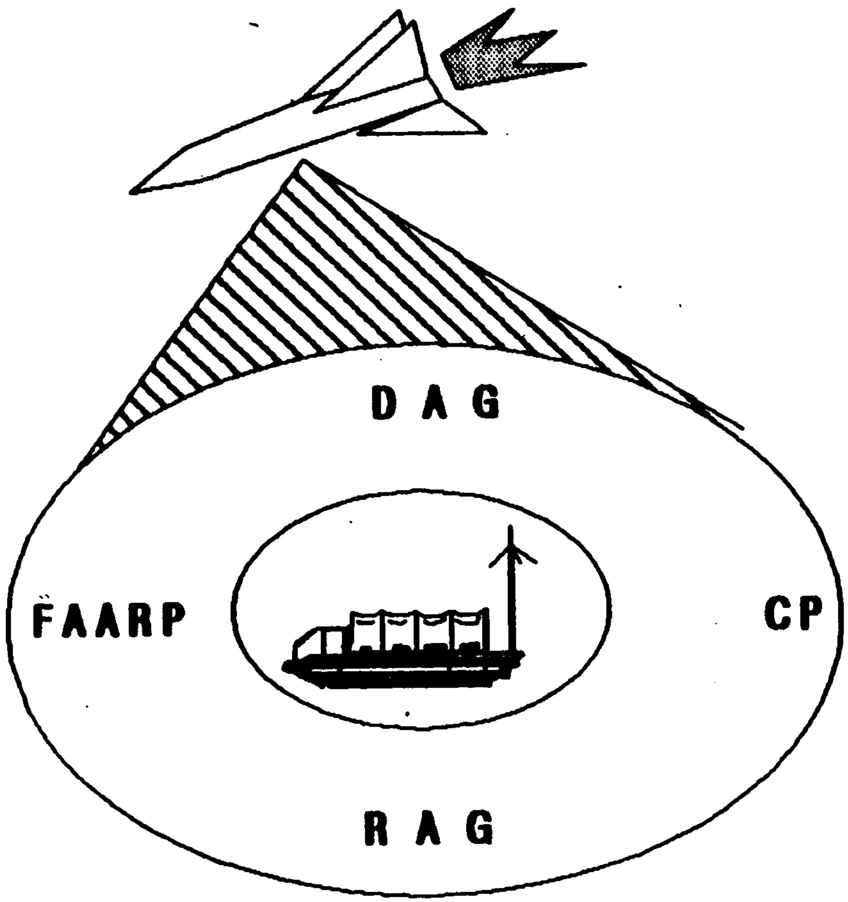


RF
NEAR TERM
MID TERM
MID TERM
FAR TERM
DE00R

ATACM/RF MUNITION & LOITERING/RF DRONE



PURPOSE: ATTACK DEEP TARGETS
- FOLLOW ON MVR
- C2
- HIGH PAYOFF

SUPPORTS: IN CONCERT WITH CDR's OPN'L AND TACTICAL PLAN

OC22

Session I
Technology Applications

Session Chairman:
Philip F. Ingersoll
Director, Technology Applications Laboratory

TECHNOLOGY APPLICATIONS LABORATORY

SLCHD-TA 394-2400
Phil Ingersoll, SES Director
Joseph W. Miller, Jr, Deputy Director
E. Ronald Sebol, Principal Laboratory Engineer
William Konick, Fuze Management

15 December 1989

Commercial (301) 394-XXXX
Autovon 290-XXXX
Facimile 394-4309

Not an official organization chart.

Special Systems Branch
Robert Christopherson
SLCHD-TA-SS 394-3720

- Chaparral M817 ESIP
- Chaparral M817E1 Design
- Electrostatic Fuzing
- Long Stand-Off Anti-Armor Fuze
- Advanced Mines

Engineering Technology Branch
John O. Wedel, Jr
SLCHD-TA-ET 394-3077

- Test Equipment Design and Fabrication
  - Chaparral M817 TDD
  - Chaparral M817E1 TDD
  - PATRIOT M818 Fuze
- Production Test Equipment Support
- M736 Recertification Test Equipment Support
- Stockpile Surveillance and Test Support
- Reliability Analysis
- Radiographics

Electronic Systems Branch
Robert S. Goodman
SLCHD-TA-ES 394-3710

- M732E2 Artillery Proximity Fuze Development
- MLRS Medium Altitude Proximity /Time Fuze
- Multi-Option Fuze for Artillery
- Electronic Safety & Arming

Mechanical Systems Branch
David L. Overman
SLCHD-TA-MS 394-2420

- Electronic Safety & Arming
- Micro Machining Research
- Fluidics
- Mechanical Engr Support
  - Fuzing
  - Traffic Jam
  - Medical R&D

Tactical Systems Branch
John M. Miller
SLCHD-TA-TS 394-2620

- XM749 Nuclear Artillery Fuze Development
- XM42 Setter Development
- GPS Applications

Energy Systems & Materials Branch
Dr. Jeff Nelson
SLCHD-TA-EM 394-3114

- Liquid Reserve Power Supplies
- Thermal Reserve Power Supplies
- Materials Engineering and Testing

FAST / Demo Office
Dr. Carl Campagnuolo
SLCHD-TA-FD 394-3193

- Wind Driven Fuze Power Supplies
  - Turbine Alternators
  - Fluidic Generators
- Man/Engine Powered Gens
- Mortar Fuzing Prod Support
- Field Assistance for Science & Technology Office

Advanced Sensors System Branch
Dr. Philip J. Emmerman
SLCHD-TA-AS 394-3000

- Artificial Intelligence Research
- Robotic Vehicle Gun System
- VISTA/CIP Battlefield Sensor Fusion and Display
- Smart Weapons Program

Systems Engineering Branch
Joseph W. Tokarcik
SLCHD-TA-SE 394-2703

- Production Contracting and Support
  - Chaparral M817
  - Chaparral M817E1
  - PATRIOT Fuze
  - M736 Nuclear Arty Fuze
  - XM749 Nuc Arty Fuze
  - G76 Series Generators

The Harry Diamond Laboratories
Technology Applications Laboratory

Personnel

Approximately 200 employees: Mostly Electronic, Chemical and Mechanical Engineers, Physicists, Mathematicians, Chemists, and technicians. Supplemented by about 30 on-site contract technical employees.

Facilities

Facilities include electronic, computer, chemistry and material testing laboratories, mechanical shops and computer aided design and drafting.

Budget

Over $40 million per year, split between in-house expenses and contractor support. In addition, approximately $300 million in on-going production contracts.

Customers

LABCOM, other Army commands, Army Project Managers, and Navy and Air Force organizations.

Projects

Chaparral Missile Fuze. Fabricated sixty fuzes at HDL in past couple of years and flight tested them at White Sands Missile Range (WSMR) with 100% score. Contractor has been competitively selected to produce 9000 fuzes to HDL technical data package.

MLRS Medium Altitude Proximity/Time Fuze. Fabricated over one hundred fuzes at HDL and flight tested them at WSMR and Dugway Proving Ground. Contractor recently selected to manufacture Engineering Development quantity of fuzes for further testing.

M732E2 Artillery Proximity Fuze. Fabricated 150 fuzes at HDL for tests at Yuma Proving Ground. Contractor fabricated 1500 fuzes for further testing. Production contractor to be competitively

PATRIOT Missile Fuze, M749 Nuclear Artillery Fuze, Long Stand-off Anti-armor Fuze, Multi-Option Fuze for Artillery, M734/M745 Mortar Fuzes, and other HDL designed fuzes. Fuzes under various stages of development and/or production.

Long Stand-off Anti Armor Fuze. Tech base developed magnetic/optical fuze for application to TOW-like weapons.

Electronic Safety and Arming. Continuing research into cost and component size reduction to make ESA's practical for rocket, mortar, and artillery fuzing.

VISTA/CIP Command Information Processor. Vehicle mounted expert system to aid field commanders in tactical decision making. Contains 17 computers, color graphics and flat panel text displays, graphics tablets, remote terminals, and sensor communications. Designed and fabricated at HDL. Follow-on work under way for Marines and USAICS.

TEAM project. Autonomous target recognition vehicle with armament. Designed as experimental research platform.

ISOPADS. Super sensitive fluidic microphones for application as soldier listening devices such as helmet mounted "bionic" ears.

Navigator. Low cost fluidic navigation system for Army vehicles. Three axis system scheduled for delivery to NTC this year.

Other Projects: Hand and Foot powered generators. Liquid and thermal reserve power supplies. Materials research and mechanical design in support of HDL projects.

Global Positioning System

John S. Eicke
Electronics Engineer
Tactical Systems Branch
Technology Applications Laboratory

TITLE: Applications of Global Positioning System Technology

TECHBASE INVESTMENT STRATEGY AREA

The Global Positioning System (GPS) has potential applications in Army Next Generation/Future Systems, including the Advanced Field Artillery System and Lightweight 155mm Towed Howitzer.

DESCRIPTION

Develop a variety of components and systems utilizing GPS which can be integrated into Army systems to establish location and velocity information. Systems to utilize such capabilities might include radiosondes and artillery registration fuzes, as well as guidance systems, search and rescue beacons, etc. Harry Diamond Laboratories is seeking industry inputs on existing as well as future technology.

OBJECTIVE/APPROACH

The objective is to use GPS to provide new and enhanced capabilities, improved accuracy, and lethality of field artillery systems.

Technical Barriers are:

- Miniaturization: Packaging GPS receiver/repeater and antenna in projectile fuze volume, MMIC components, miniature antennas
- Receiver Dynamics: Fast acquisition receivers in high dynamic environments, receivers utilizing NAVAID inputs
- High-G: Receiver/repeater and components for use in artillery projectile environment
- Processing: Near real-time data processing, differential measurement systems
- Survivability: Steerable null antennas, signal processing to enhance ECM performance, techniques, GPS/Glonass compatible systems

REMARKS

In direct support of:

- LABCOM GPS Artillery Spotter Round Cooperative program
- LABCOM GPS Radiosonde Cooperative program

Technical POCs: Mr. John Miller, Telephone: 301-394-2620; Mr. John Eicke, Telephone: 301-394-2620

GPS MILITARY APPLICATIONS

HARRY DIAMOND LABORATORIES

US ARMY LABORATORY COMMAND

- En Route Navigation
- Low-Level Navigation
- Target Acquisition
- Close Air Support
- Missile Guidance
- Command & Control
- All-Weather Air Drop
- Sensor Emplacement
- Precision Survey
- Instrument Approach

- Rendezvous
- Coordinate Bombing
- Remotely Piloted Vehicle Operations
- Barebase Operations
- Search and Rescue
- Photo-Reconnaissance
- Range Instrumentation
- Mine Emplacement & Countermeasure

CURRENT HDL GPS PROGRAMS

* GPS ARTILLERY REGISTRATION ROUND

  Provide trajectory data to gun position

  Packaged in standard fuze

  GPS Translator approach

  HDL, HEL and BRL cooperative program

* GPS RADIOSONDE

  Provide wind velocity data

  GPS translator and receiver approachs considered

  HDL, ASL and ETDL cooperative program

STATUS OF GPS PROGRAMS

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

* FY90-91: FEASIBILITY STUDIES & EVALUATIONS
* FY92: FIELD DEMONSTRATIONS
* FY93: TRANSITION TO FULL SCALE DEVELOPMENT
* PRODUCTION

  RADIOSONDE - 50,000 UNITS OVER 5 YEARS

  REGISTRATION FUZE - 50,000 UNITS OVER 5 YEARS

AREAS OF INTEREST IN GPS

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

* CUSTOM GPS COMPONENTS
* SPECIALIZED GPS RECEIVERS
* GPS RECEIVER ANALYSIS TOOLS
* GPS TRANSLATORS
* GPS ANTENNAS

HARRY DIAMOND LABORATORIES

U. S. ARMY
LABORATORY COMMAND

Fuzing

William L. Konick
Fuzing Manager
Technology Applications Laboratory

TITLE: Fuzing

TECHBASE INVESTMENT STRATEGY AREA

Fuzing will continue to have applicability to the broad spectrum of munitions systems from inexpensive ammunition items through sophisticated missile systems. Fuzes are used to keep the munition item safe to handle and store while providing optimum warhead lethality against the target after sensing the correct launch environment. Fuzing systems developed in the Technology Applications Laboratory at Harry Diamond Laboratories (HDL) are generically applicable to Next Generation / Future Systems (NG/FS) in the following Battlefield Functional Mission Areas: Fire Support, Air Defense, Close Combat Light, and Close Combat Heavy. An exhaustive list of specific systems will not be attempted here. However, three representative NG/FS are associated with each techbase work package in the briefing.

DESCRIPTION

Develop a variety of fuzing components, such as electronic safing and arming devices and power supplies, and fuzing systems for Army munitions. Pack as much sophistication as possible into physically small fuzing systems to enhance overall system lethality, and deal with countermeasures of all types. Simultaneously, satisfy other important constraints such as safety, reliability, cost, human engineering, and fire control system interface. Other important issues that must be dealt with in fuzing development include use of insensitive munitions, and understanding the effects of long-term storage. The HDL Technology Applications Laboratory not only performs techbase development of fuzes, but also has strong customer-funded fuzing programs in engineering development, engineering in support of production, and product improvement programs.

OBJECTIVE/APPROACH

The objective is to continuously improve the effectiveness of the fuzes that are provided to the Army for its munitions.

Technical barriers are:

- Miniaturization: Packaging sophisticated sensors and signal processors into standardized ammunition fuze contours and into vanishingly small volumes in precision guided munitions and missiles.

- Signal processing and algorithm development: Signal processors must be able to handle the increased quantity and rates of data that the new sensors can provide. Targets must be discriminated from clutter at extended detection ranges.

- Pre-launch power: Certain ammunition items will require the presence of electrical power for hand setting before use. How will this be accomplished while satisfying long-term storage requirements?

- Encounter simulation: Modeling and hardware-in-the-loop capabilities must be upgraded to accommodate new sensors and encounter scenarios.

- Low energy fire set components: Critical for achieving electronic safing and arming performance and cost goals.

REMARKS

Customer programs in direct support of:

- PM-Patriot
- PM-Chaparral
- PM-Mortar Systems
- PM-Nuclear Munitions
- AMCCOM
- PM-MLRS

Techbase in direct support of:

- PM-Fuzes
- PM-AFAS
- PM-TOW
- PM-AAWS-M

Technical POC: Mr. William Konick
SLCHD-TA
(202)394-2400

ADVANCED PLANNING BRIEFING FOR INDUSTRY

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

TECHNOLOGY APPLICATIONS LABORATORY

"FUZING"

Presented By
William L. Konick
(202)394-2400

SESSION I ~ 23 JANUARY 1990

NOTICE!

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

In accordance with applicable regulations, the information in this briefing is conditioned by the following:

- The estimates are based on the best information available.

- The information is subject to modification and is in no way binding on the Government.

- More specific information relating to the procurement of any individual item or class of items will not be furnished until the proposed acquisition is synopsized in the Commerce Business Daily or the solicitation is issued.

Outline

- Background
- Existing fuze production contracts
- Fuzes that are soon to go into production
- Fuzing tech base programs in the Technology Applications Laboratory

Background

Fuzing Mission at HDL

LABCOM Regulation 10-1:

HDL has Army leadership for -

Providing assistance to hardware developers through the design and application of advanced electronic fuzing and radar technologies

Mission Areas Supported

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

- Fire Support
- Air Defense
- Close Combat Light
- Close Combat Heavy

Fuzes in Production

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

- Patriot
- Chaparral
- M734 Mortar Fuze
- M745 Mortar PD/Practice Fuze
- M749 Fuze - 155mm Nuclear Artillery

Patriot M818E2

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

- Description: Fuze for surface-to-air missile
- Status: In production
- Current contractor -
  Allied Signal, Bendix Communications Division
  Contract award Nov 88, $50M for 1027 units
  First article: Jan 90
  Delivery schedule: through Apr 91
- Next contract to award: approx 31 Jan 90
  FY90 quantity: 912 units
  Priced options for FY91 & FY92: 1765 units max

Year:	FY91	FY92
Max Quan:	1065	700

- POC name, office symbol, phone:
  David Thier, SLCHD-TA-SE, (202)394-2703

Chaparral
M817E1 TDD

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

- Description: Fuze for surface-to-air missile
- Status: In production
- Current contractor -
  Loral (Fairchild Weston Systems Inc)
  Contract award May 89, $3.6M for 390 units
  First article (TDD): May 90
  Basic delivery schedule: May 90 - Nov 90
- Options:

Year:	FY90	FY91	FY92	FY93	FY94
Max Quan:	1200	2000	2000	2000	2400

- POC name, office symbol, phone:
  Les Kitchman, SLCHD-TA-SE, (202)394-2703

M734

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

- Description: Multi-option fuze for mortar cartridges
  Functions: proximity, near-surface-burst,
  impact, delay
- Status: In production
- Key milestones
  TC 1977 on 60mm ctg, TC 1987 on 81mm ctg
  FY90 will TC on 4.2in and 120mm ctgs
- Current contractors: Accudyne, Eastman Kodak
- FY90 buy for 187K units on the street, award Mar 90
- Future requirements:

Year	FY91	FY92	FY93	FY94
Units(K)	124	54	128	39

- POC name, office symbol, phone:
  Frank Blodgett, SLCHD-TA-FD, (202)394-3193

M745

- Description: Fuze, PD, Dual Purpose for mortar cartridges
- Status: In production
- Key milestones
  - TC 1988 on 60mm WP and HE ctgs
  - FY90 will TC on M888 60mm HE ctg
  - FY90 will TC on 4.2in and 120mm smoke ctgs
- Current contractor: Accudyne, FY89 buy, 185K units
- FY90 buy for 47K units on the street, award Mar 90
- Future requirements:

Year	FY91	FY92	FY93	FY94
Units(K)	124	54	128	39

- POC name, office symbol, phone:
  Frank Blodgett, SLCHD-TA-FD, (202)394-3193

M749

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

- Description: Fuze for 155mm nuclear artillery projectile
- Status: In production
- Current contractor -
  Motorola
  Contract award Mar 88, $34.5M for 527 units
  Option exercised Nov 89, $15.3M for 248 units
  Delivery schedule: Aug 89 - 1Q FY92
- POC name, office symbol, phone:
  Bill Webster, SLCHD-TA-SE, (202)394-2703

Fuzes to go into Production

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

- M732E2 PIP Artillery Fuze
- XM450 MAP/T Fuze for MLRS

HARRY DIAMOND LABORATORIES

US ARMY
LABORATORY COMMAND

M732E2

- Description: Proximity fuze for artillery unitary warhead burster projectiles, including rocket-assisted projectiles
- Status: Production to start FY91
- Key milestones
  - IPR Dec 89
  - TC Jan 90
- Contract opportunities: AMCCOM will attempt to limit procurement to MOB base
- Future requirements:

Year	FY91	FY92	FY93	FY94
Units(K)	190+	0	0	0

- POC name, office symbol, phone:
  Bob Goodman, SLCHD-TA-ES, (202)394-3710

XM450

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

- Description: Proximity and time fuze for MLRS binary chemical warhead
- Status: Full scale development (6.4)
- Key milestones
  PRR Feb 90, PQT FY91
  Milestone III IPR 1Q FY92
  Production FY92
- Current contractor: (FSD) 500 units
  Joint venture of KDI Precision Products and
  Electronic Development Corporation
- Production contract to be full and open competition
  Years: FY92 - FY97
  Quantities: Classified
- POC name, office symbol, phone:
  Bob Goodman, SLCHD-TA-ES, (202)394-3710

HARRY DIAMOND LABORATORIES

US ARMY
LABORATORY COMMAND

Fuzing Tech Base

- MOFA (Multi-Option Fuze for Artillery)
- LSAA (Long-Standoff Anti-Armor)
- ESA (Electronic Safing and Arming)

MOFA

- Description: Single fuze for use on all burster projectiles in all current and developmental field artillery systems
- Next generation / future systems supported:
  - Advanced Field Artillery System (AFAS)
  - Extended Range Artillery Projectile II (ERA II)
  - Lt Wt 155mm Towed Howitzer
- Key technologies:
  - MIMIC
  - Flexible LCD
  - Active Battery for pre-launch power
- Status: in last year of 6.2
- Key milestones - to be managed by PM-AFAS
  - Proof of Principle (6.3a): FY91 - FY92
  - Full Scale Development (6.4): FY93 - FY96
  - Production start: FY97
- HDL contract opportunities - limited to component development
- POC name, office symbol, phone:
  - Bob Goodman, SLCHD-TA-ES, (202)394-3710

US ARMY
LABORATORY COMMAND

LSAA

HARRY DIAMOND LABORATORIES

- Description: Low-cost magnetic / optical anti-armor standoff fuze
- Next generation / future systems supported:
  - Line of Sight Antitank
  - Multimode Antiarmor Weapon System (MMAAWS)
  - Future Smart Munition
- Key technologies:
  - Low-cost optics
  - Triple-axis magnetometer
  - Signal processing
- Status: Tech base (6.2)
- Key milestones:
  - FY89 - Transferred technology to PM-TOW
  - FY90 - Perform smoke and countermeasures field tests
  - FY91 - Investigate methods to extend standoff distance
- Contract opportunities - none, in-house effort
- POC name, office symbol, phone:
  - Bob Christopherson, SLCHD-TA-SS, (202)394-3720

10

ESA

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

- Description: Development of miniaturized electronic safing and arming (ESA) technology with emphasis on insertion into low-cost systems (missiles, rockets, artillery, mortars)
- Next generation / future systems supported:
  Very broad range of applicability, including -
    Patriot 2000
    Multimode Antiarmor Weapon System
    Low Intensity Conflict Rocket System (LICRS)
- Key technologies: Efficient, low-cost, rugged and reliable components
  Capacitors - high voltage
  Miniaturized DC to DC converters
  High voltage switches
  Low-energy slapper bridges
- Status: Tech base (6.2)
- Key milestones:
  FY90 - Zuni flight test (modified ATACMS) and mortar technology demos; Support PM-AAWS-M risk reduction ESA development
  FY91 - Flight test generic low-cost missile ESA
- HDL contract opportunities - component development
- POC name, office symbol, phone:
  Bob Goodman, SLCHD-TA-ES, (202)394-3710

BATTLEFIELD AUTOMATION

PRESENTED BY

DR. PHILIP J. EMMERMAN

ADVANCED SENSORS SYSTEMS BRANCH

Harry Diamond Laboratories
2800 Powder Mill Road
Adelphi, Md 20783-1197
(301) 394-3000

MULTI-SENSOR PROCESSING

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

- REMOTE, COMBAT INFORMATION PROCESSOR
- LOCAL, AUTOMATIC TARGET ACQUISITION

HARRY DIAMOND LABORATORIES

US ARMY LABORATORY COMMAND

RELATED PROGRAMS

PROGRAM	SPONSOR	FOCUS
COMBAT INFORMATION PROCESSOR		
SMART WEAPONS SYSTEM	LABCOM/BRL	FIRE SUPPORT
CIP TESTBED	MARINES	COMMAND AND CONTROL
AI MODULE	DCSINT	INTELLIGENCE
MULTI-MISSION AREA SENSOR	PM-TAAWS	AIR DEFENSE
ROBOTIC (ATR)		
TECHBASE ENHANCEMENTS FOR		CLOSE COMBAT
AUTONOMOUS MACHINES	LABCOM/HEL	LIGHT AND HEAVY

(TAAWS) TARGET ACQUISITION FOR ARMY WEAPON SYSTEMS
(ATR) AUTOMATIC TARGET RECOGNITION

UMV3.DWG

OVERALL GOAL

DETERMINE THE OPERATIONAL BENEFITS

WHICH RESULT FROM PROVIDING

<u>NEAR-REAL-TIME</u> COMBAT INFORMATION

TO THE <u>TACTICAL</u> COMMANDER

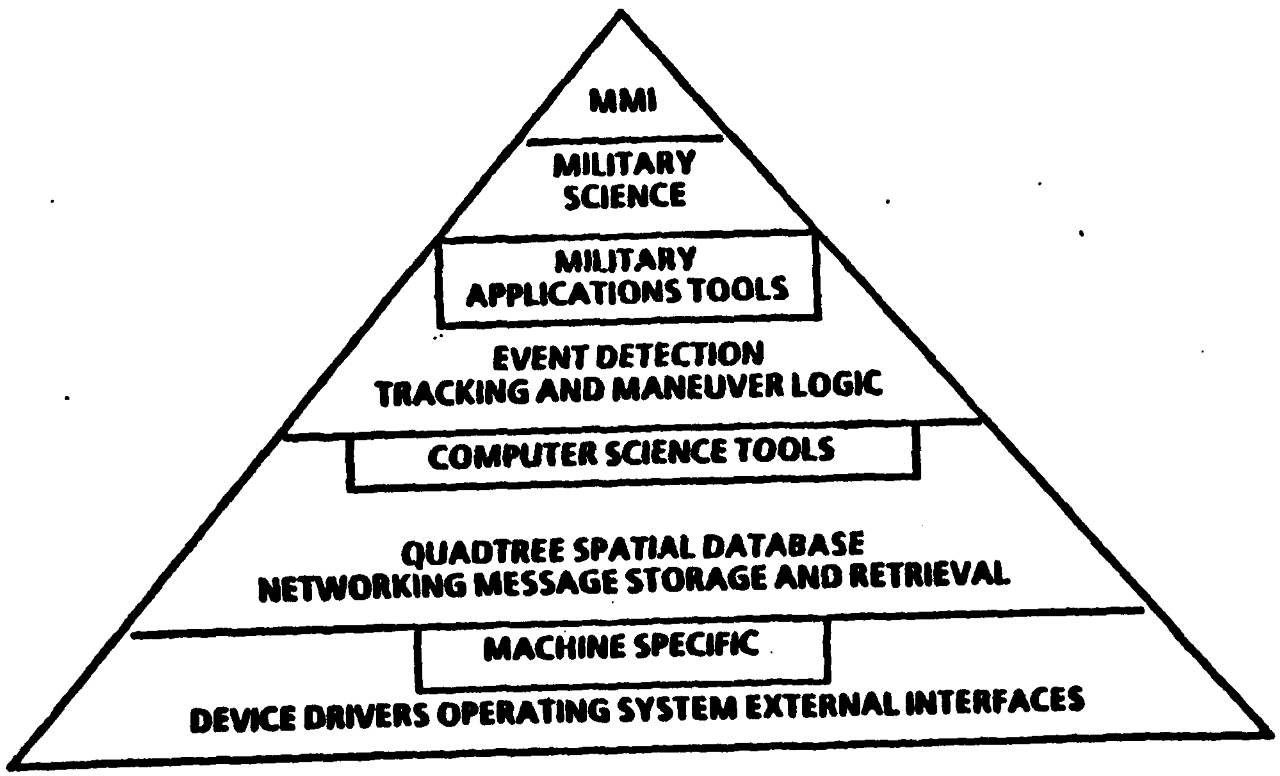
OBJECTIVES

- DETERMINE AND EVALUATE OPERATIONAL REQUIREMENTS
  - BRIGADE LEVEL PROCESSING AND INTERFACE REQUIREMENTS
  - SENSOR PROCESSING AND INTEGRATION REQUIREMENTS
  - COLLATERAL DATA BASE REQUIREMENTS
- VALIDATE OPERATIONAL BENEFITS OF ADVANCED TECHNOLOGIES
  - KNOWLEDGE BASED DECISION AIDS
  - MULTIPROCESSING
  - SPECIALIZED DATA BASES
  - PROGRAMMABLE COMMUNICATION INTERFACES
- PROVIDE LESSONS LEARNED AND DATA TO SUPPORT FUTURE PLANNING OF ARMY COMMAND AND CONTROL SYSTEMS

SOFTWARE DEVELOPMENT AREAS

US ARMY
LABORATORY COMMAND

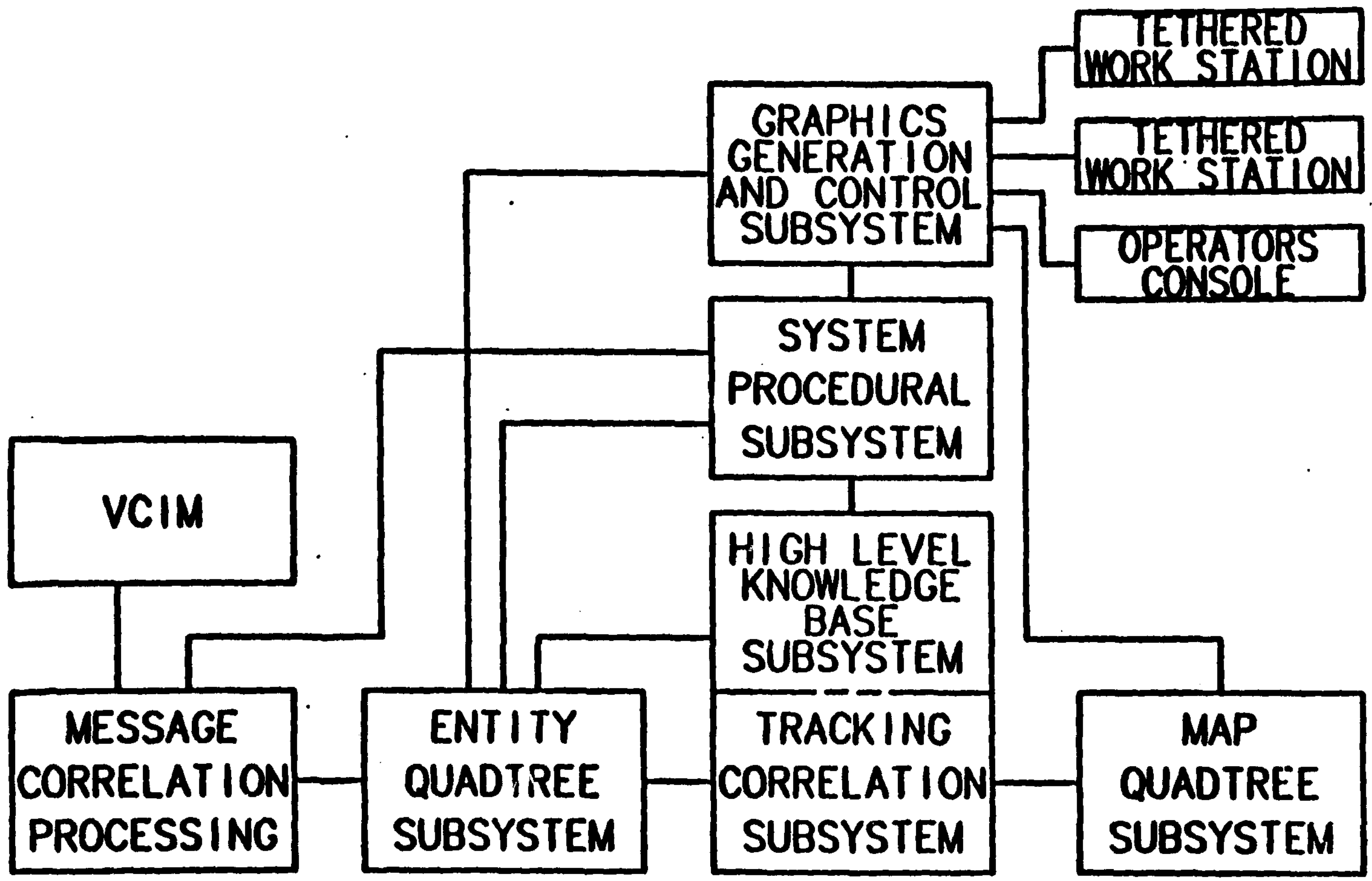
HARRY DIAMOND LABORATORIES



CIP KNOWLEDGE BASED PROCESSOR SUBSYSTEM BLOCK DIAGRAM

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES



UMV4.DWG

CURRENT FUNCTIONALITY

US ARMY
LABORATORY COMMAND

- ELECTRONIC MAPS (VECTOR FEATURES)
- TERRAIN ANALYSIS (PLANNING AND EXECUTION)
  - LINE OF SIGHT
  - FIELD OF VIEW
  - MOBILITY CORRIDORS
  - ROUTE PLANNING
- THREAT ANALYSIS
  - TARGET CLUSTERING
  - TARGET PREDICTION
- TACTICAL MESSAGE SUPPORT
  - PROTOCOLS (MTS, TACFIRE, MISMART)
  - AUTOMATIC PARSING
  - AUTOMATIC STORAGE
  - SELECTED RETRIEVAL
  - CONFIGURABLE AUTOMATIC DISTRIBUTION

CURRENT FUNCTIONALITY (CONTINUED)

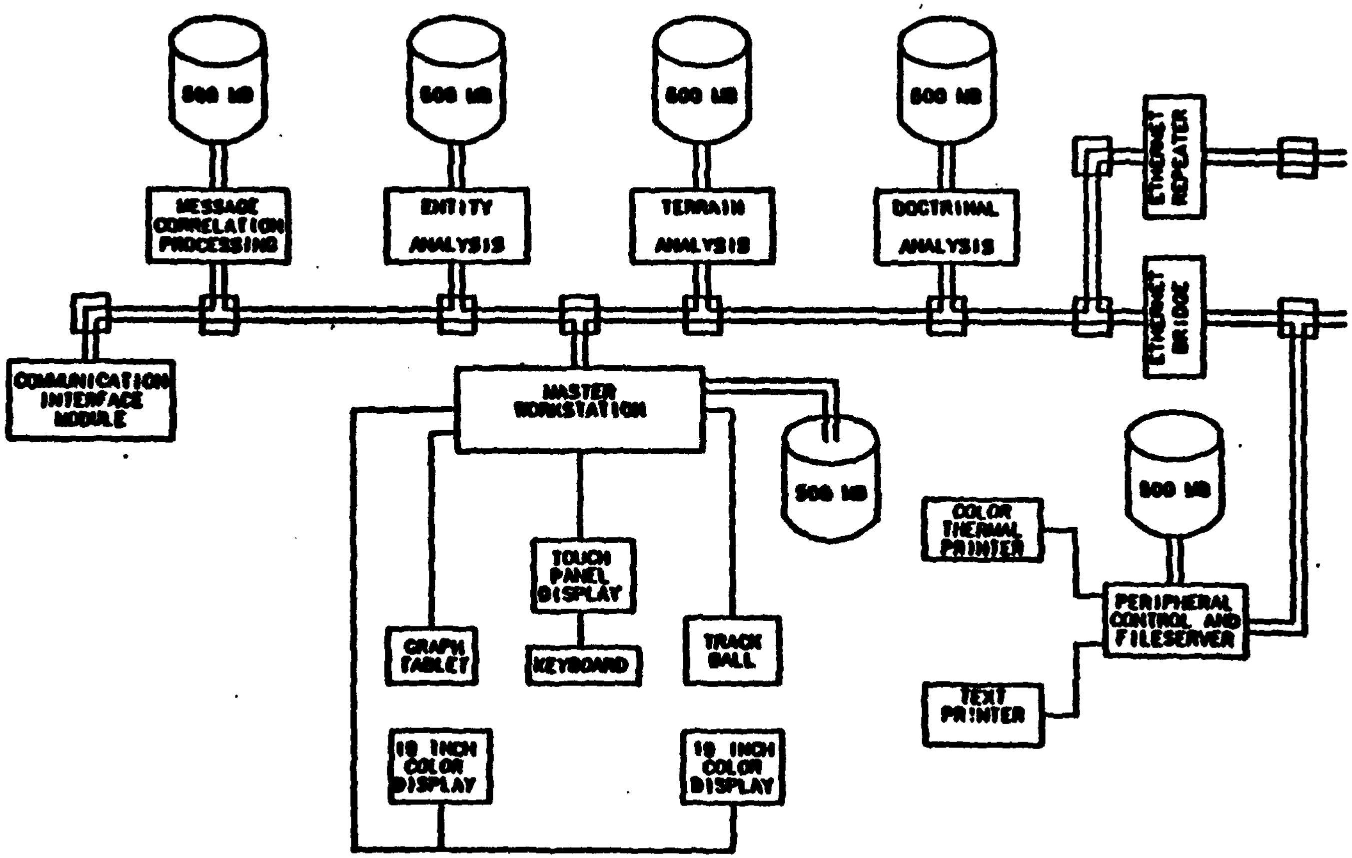
US ARMY
LABORATORY COMMAND

- UNITS DATABASE
  - TRACKING
  - CORRELATION
  - SHARED AMONG ALL USERS
  - AUTOMATIC UPDATING FROM MESSAGES
  - SUPPORTS STANDARD MILITARY SYMBOLS (FM 101-5-1)
- CONTROL MEASURES DATABASE
  - SHARED AMONG ALL USERS
  - SUPPORTS STANDARD MILITARY SYMBOLS (FM 101-5-1)
  - EVENT DETECTION
- HARD COPY
  - PAPER
  - OVERLAY (STANDARD SCALES)

CIP FUNCTIONAL BLOCK DIAGRAM

US ARMY LABORATORY COMMAND

HARRY DIAMOND LABORATORIES



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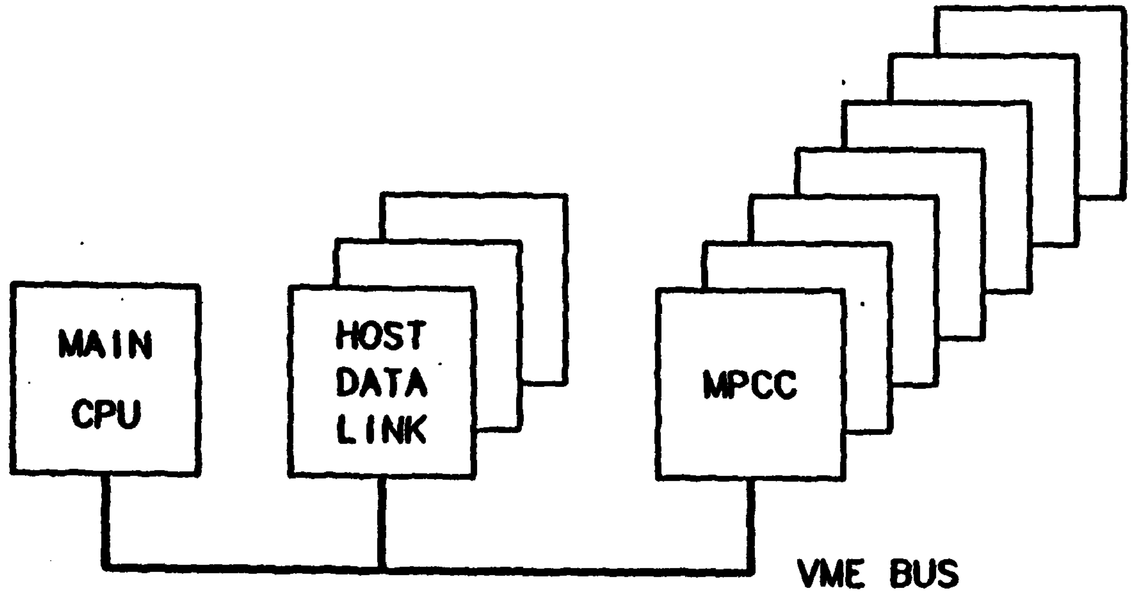
CIM ARCHITECTURE



CHOOSE ONE

RS-232
MIL 1553
ETHERNET

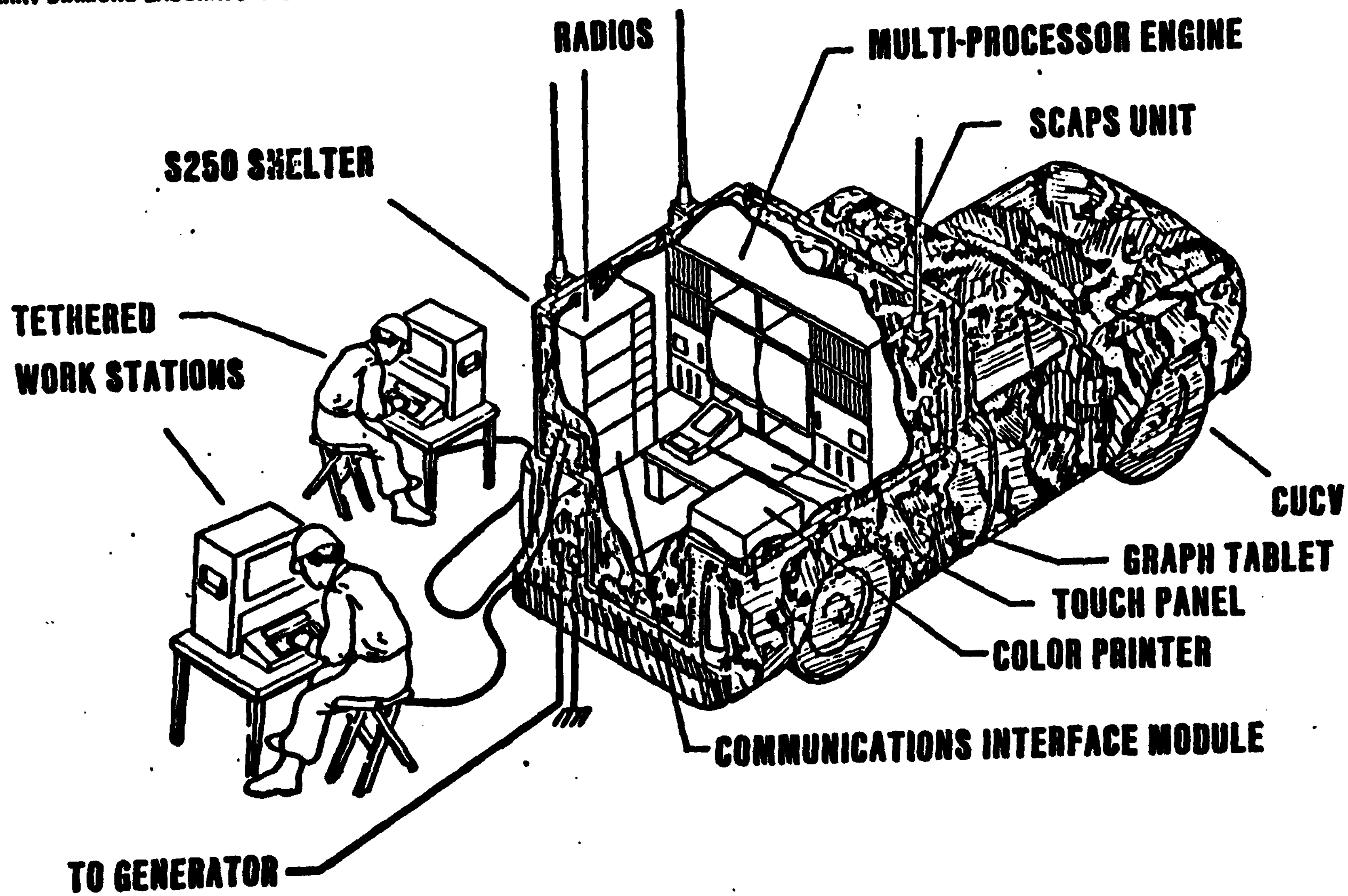
UP TO SEVEN CHANNELS IN VEHICULAR CHASSIS

HARRY DIAMOND LABORATORIES

BRIGADE MULTI-FUNCTIONAL AREA PROCESSOR

TEST BED

US ARMY
LABORATORY COMMAND



HARRY DIAMOND LABORATORIES

TEST BED FEATURES

US ARMY
LABORATORY COMMAND

- FLEXIBLE, POWERFUL, AND MOBILE REAL TIME TOOL FOR MULTI-FUNCTIONAL AREA AND MULTI-SENSOR INTEGRATION.
- ENHANCES THE TRACKING OF ENTITIES/TARGETS BY UTILIZING TERRAIN AND DOCTRINAL KNOWLEDGE.
- AUTOMATICALLY DETECTS EVENTS OF ENTITY MOVEMENT INTO OR OUT OF A MILITARY AREA OF INTEREST.
- SUPPORTS MULTIPLE COOPERATING EXPERT SYSTEMS.
- EXCELLENT GROWTH POTENTIAL
  - HARDWARE • OPEN TO SEMICONDUCTOR INDUSTRY ADVANCES. (VME STANDARD)
  - SOFTWARE • OPEN TO ADVANCES IN REAL TIME OPERATING SYSTEMS, LANGUAGES, AND APPLICATIONS. (UNIX AND REAL TIME KERNALS)

UMV5.DWG

AUTOMATIC TARGET ACQUISITION AND INTEGRATION GOALS

HARRY DIAMOND LABORATORIES

US ARMY LABORATORY COMMAND

- EXTREMELY LOW PROBABILITY OF FALSE ALARM CONSISTENT WITH ROBOTIC MISSIONS
- VEHICLE SURVIVABILITY, AFFORDABILITY, SIZE
- REAL WORLD SCENARIOS - DAY/NIGHT, CLUTTER, OBSCURANTS
- NAVIGATION AND ATA INTEGRATION
- HIGH OVERALL SYSTEM RELIABILITY/ FAILSAFE OPERATION

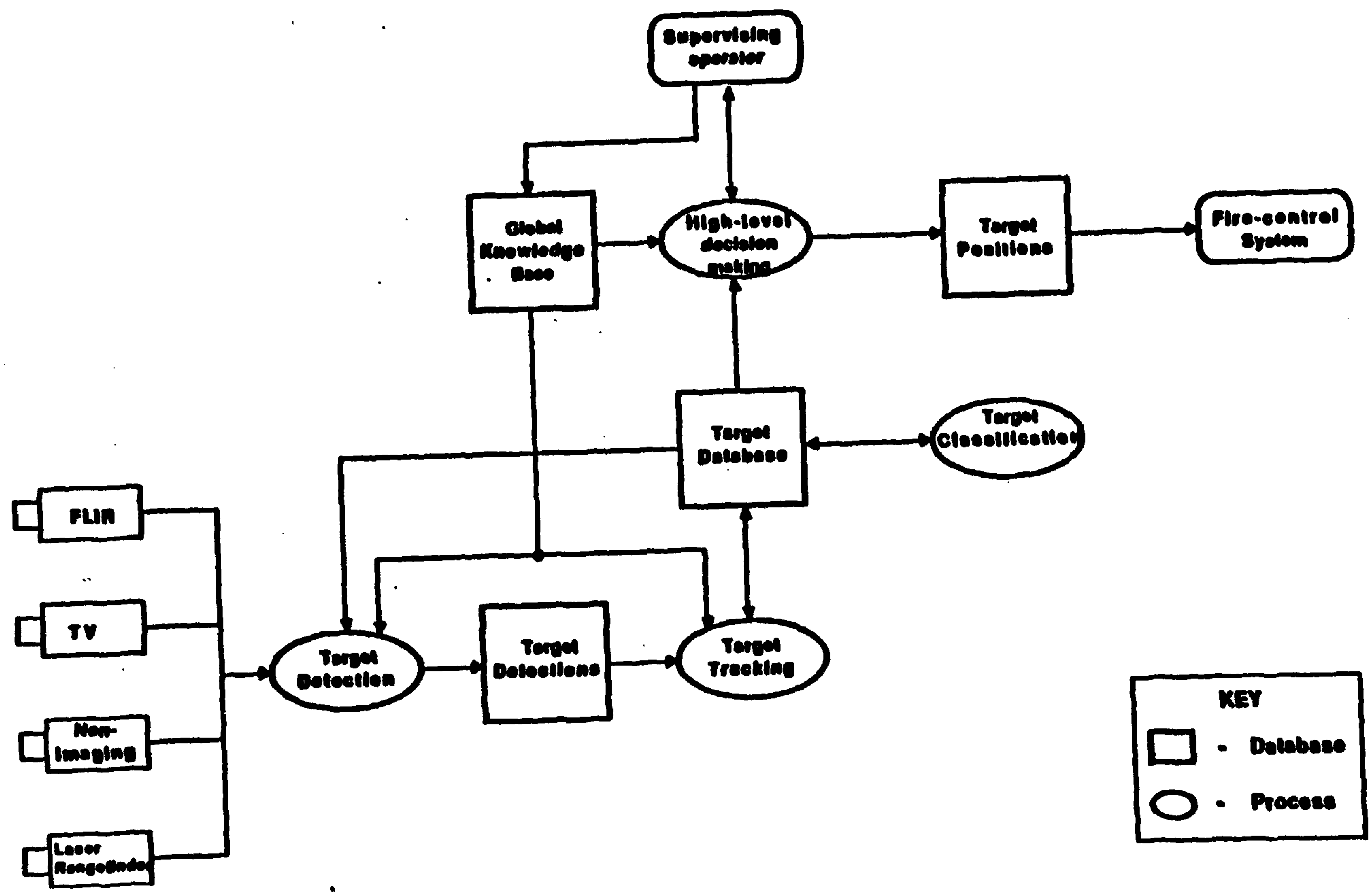
APPROACH

- PASSIVE SENSORS
- SENSOR FUSION
- OPEN SYSTEMS APPROACH, HARDWARE AND SOFTWARE
- ALGORITHMS BASED ON MOTION DETECTION, SPATIAL CORRELATION, AND USE OF CONTEXTUAL KNOWLEDGE

HIGH-LEVEL ATA BLOCK DIAGRAM

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES



FUTURE CAPABILITIES

- WEATHER/NBC MODEL
- MOBILITY MODEL
- SMALLER, LIGHTER SYSTEMS
- COLLECTION MANAGEMENT
- SITUATION ASSESSMENT
- TARGET DEVELOPMENT
- ADVANCED MULTI-SENSOR CORRELATION
- FUTURE USER DEFINED REQUIREMENTS

HARRY DIAMOND LABORATORIES

U. S. ARMY
LABORATORY COMMAND

Session II
Nuclear Survivability

Session Chairman:
Dr. John C. Ingram
Deputy Director, Nuclear Survivability Laboratory

NUCLEAR SURVIVABILITY PROGRAM

The Harry Diamond Laboratories, Nuclear Survivability Program develops a full range of verified and demonstrated technology products and methodologies required to assure the future survivability of U.S. Army materiel during and after a nuclear exchange. HDL as the AMC Lead Laboratory for nuclear weapons effects survivability is charged to formulate, budget and execute this broad technology program that is required so that mission essential Army equipment can be made as survivable as the soldier This is needed so Army can avoid the potentially disastrous situation of having soldiers who are willing and able to fight after a nuclear attack, but are unable to do so because combat systems fail to withstand hostile nuclear environments.

The 6.2 Nuclear Survivability Technology part of the overall Army Nuclear Survivability Program provides technology products for all nuclear effects areas (e.g. EMP, radiation and blast/thermal) including the simulation of these effects and the development of nuclear hardening methods and techniques needed for designing nuclear-survivable equipment, testing it and assessing and validating systems survivability and maintaining that survivability throughout the life cycle. The continuing evaluation of emerging technologies that are being introduced into new and product improved military system designs make this tech base an iterative program that provides the Army with affordable hardening solutions for development and fielded system use.

Nuclear weapons effects and simulators are studied and developed, maintained and improved for use in designing survivable equipment. Radiation shielding technology is developed and demonstrated for protection of crews in armored vehicles.

There are several major areas of concern in this program. First is the high altitude electromagnetic pulse (HEMP) in which advanced protection devices are being developed to prevent the loss of the entire inventory of electronic military systems from a HEMP nuclear weapon burst. Additionally, this task area develops analysis methods and techniques for hardening tactical Army systems to EMP effects and the capability to simulate the new military standard, MIL-STD-2169. Free field current injection and computer simulation techniques are being used to assess the impact of this new environment on past and future EMP hardening approaches.

The next major area of interest, is Air Blast and Thermal radiation. Mobile tactical systems are particularly vulnerable to being overturned by the blast wave. This task will develop advanced techniques like lightweight outriggers and other overturning restraints for use with Army vehicles that carry mobile C3I systems. Additionally, the program will conduct Large Blast/Thermal Simulator (LB/TS) cost reduction research in cooperation with DNA. Non-ideal blast will also be investigated.

Finally the Tactical Source Region (TSR) area is concerned with an annular area around the burst point of a low yield nuclear weapon beyond the range where personnel and equipment are disabled by the blast and thermal radiation. In this area, nuclear radiation is being deposited in the air creating a complex, time varying radiation, ionizing electron and electromagnetic pulse (EMP) environment. This task objective is to develop the analytical methods and basic technology necessary to ensure the survivability of Army equipment in this environment. Resolution of the tactical source region problem will involve above ground tests in AURORA and underground nuclear tests (UGT) and will help develop tactical source region hardening requirements and lead to approaches for TSR simulation.

The Nuclear Effects Support Team is a 6.3b AMC sponsored program funded to facilitate transfer of nuclear survivability information from the research community to systems under development. NEST assistance is available to meet the needs of project managers

The Nuclear Survivability Assessment Team (NSAT) Program, has the goal of facilitating Army nuclear survivability by analysis and test and where required the hardening of unhardened equipment fielded. The Army equipment list for this program has been prioritized by the Training Doctrine Command for test, evaluation, and hardening retrofit. Based on the work NSAT does, a database has been established for future Army use.

The 6.2 nuclear survivability technology products are developed by HDL and fed into demonstration packages that integrate into standard nuclear survivability hardening modules for use by project managers and major subordinate command elements working the nuclear survivability of future generation military systems. The major areas being worked on are covered in the following paragraphs.

The high altitude EMP (HEMP) Defense Standards and Specifications Program (DSSP) is directed at providing support to high priority time sensitive, strategic ground based mobile C3I systems. The program demonstrates low risk EMP hardening for these systems and develops associated specifications , standards, hardening guidelines and practices.

The development of hardness assurance/hardness maintenance (HA/HM) techniques and procedures is being developed for application to the acquisition and the operational phases of a nuclear hardened system. The Army needs these techniques and procedures so that systems can be kept survivable. The increasing numbers of Army systems that have nuclear hardening criteria make this and future derivative efforts an area of important and continuing concern.

HDL has pursued a non-developmental item (NDI) advanced system hardening effort for the past several years that has the objective of generating techniques and methods for selecting or modifying NDI equipment so that it can survive in a nuclear battlefield environment containing initial nuclear radiation (INR), electromagnetic pulse (EMP), and blast/thermal radiation. Survivability problems for different NDI categories have been identified and approaches developed on how these problems can be solved. Guidelines for selection of nuclear survivable NDI technologies are output of this program. Because of the increasing use of the NDI procurement route, this and its future derivative efforts are clearly going to be more important to the Army in the coming years.

Finally, there is the Large Blast/Thermal Simulator (LB/TS) related program whose objectives and approach have been developed by BRL with HDL and DNA support to provide realistic cost-effective means of simulating the response of tactical systems to the full threat yield spectrum of blast/thermal environments. DNA has agreed to build the LB/TS and finance its characterization and operation by AMC on an Army site. This task will support the BRL "probative tube", which is a small scale model of the LB/TS where tube/target interaction can be studied along with instrumentation and potential LB/TS improvements. Using the probative tube, improvements can be demonstrated and the technology transferred to the full scaled LB/TS. If successful, these efforts can reduce the original cost of the LB/TS and the subsequent operating costs by millions of dollars. Additionally, BRL can use it as a modern blast simulator in its own right.

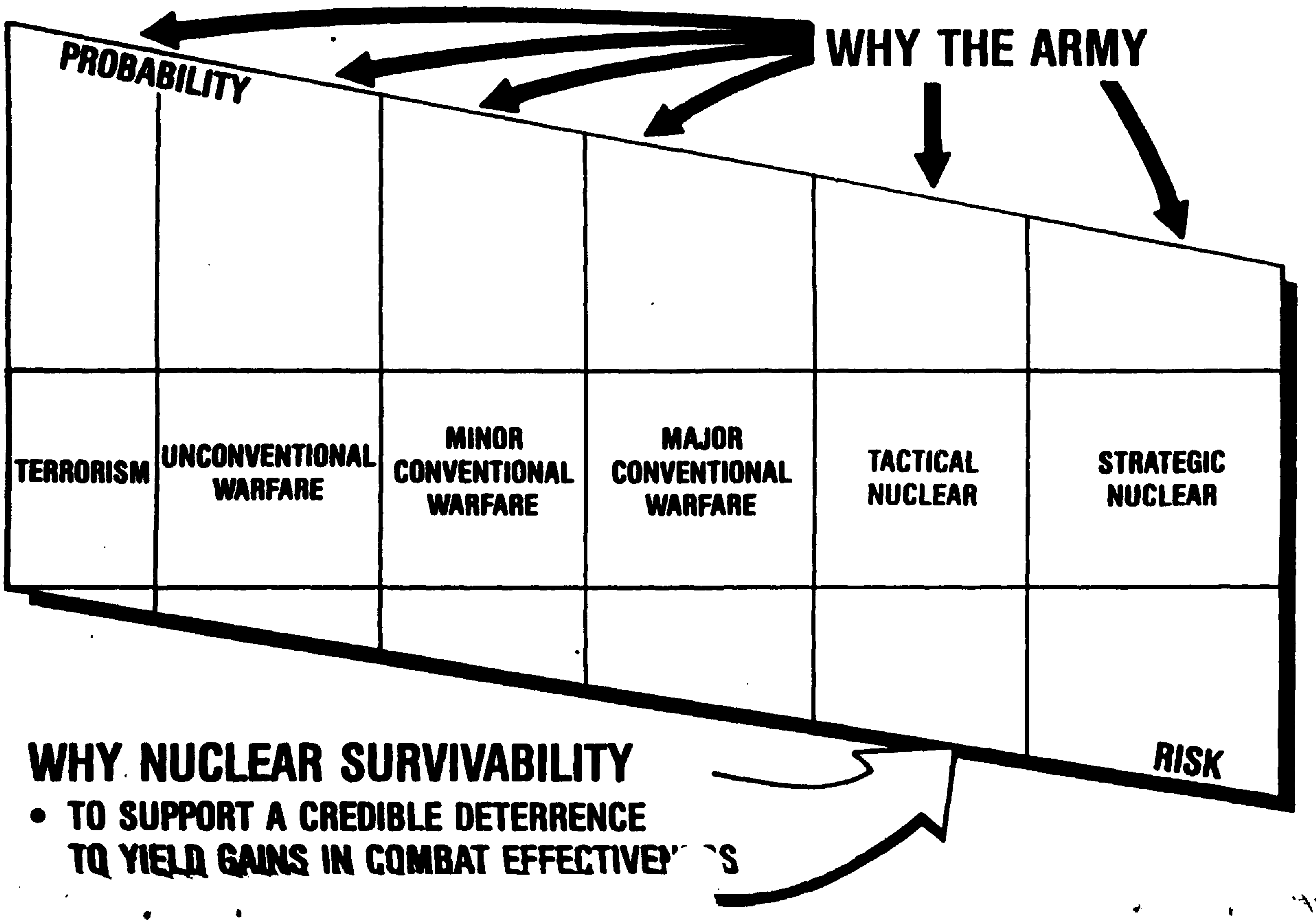
HARRY DIAMOND LABORATORIES

US ARMY
LABORATORY COMMAND

OUTLINE

- o BACKGROUND
- o THREAT
- o POLICY AND REQUIREMENTS
- o ORGANIZATION INTERFACES
- o TECHNOLOGY INVESTMENT STRATEGY
- o TECHNOLOGY AREAS OF INTEREST
- o SUMMARY

SPECTRUM OF CONFLICT



WHY NUCLEAR SURVIVABILITY

- TO SUPPORT A CREDIBLE DETERRENCE TO YIELD GAINS IN COMBAT EFFECTIVENESS

NUCLEAR SURVIVABILITY

CAPABILITY OF SYSTEM TO WITHSTAND INITIAL NUCLEAR WEAPONS EFFECTS (BLAST, THERMAL, RADIATION, EMP) AND STILL ACCOMPLISH ITS MISSION.

CAN DO BY --

- *HARDENING*
- *REDUNDANCY*
- *TIMELY RESUPPLY*
- *MITIGATION TECHNIQUES*

HARRY DIAMOND LABORATORIES

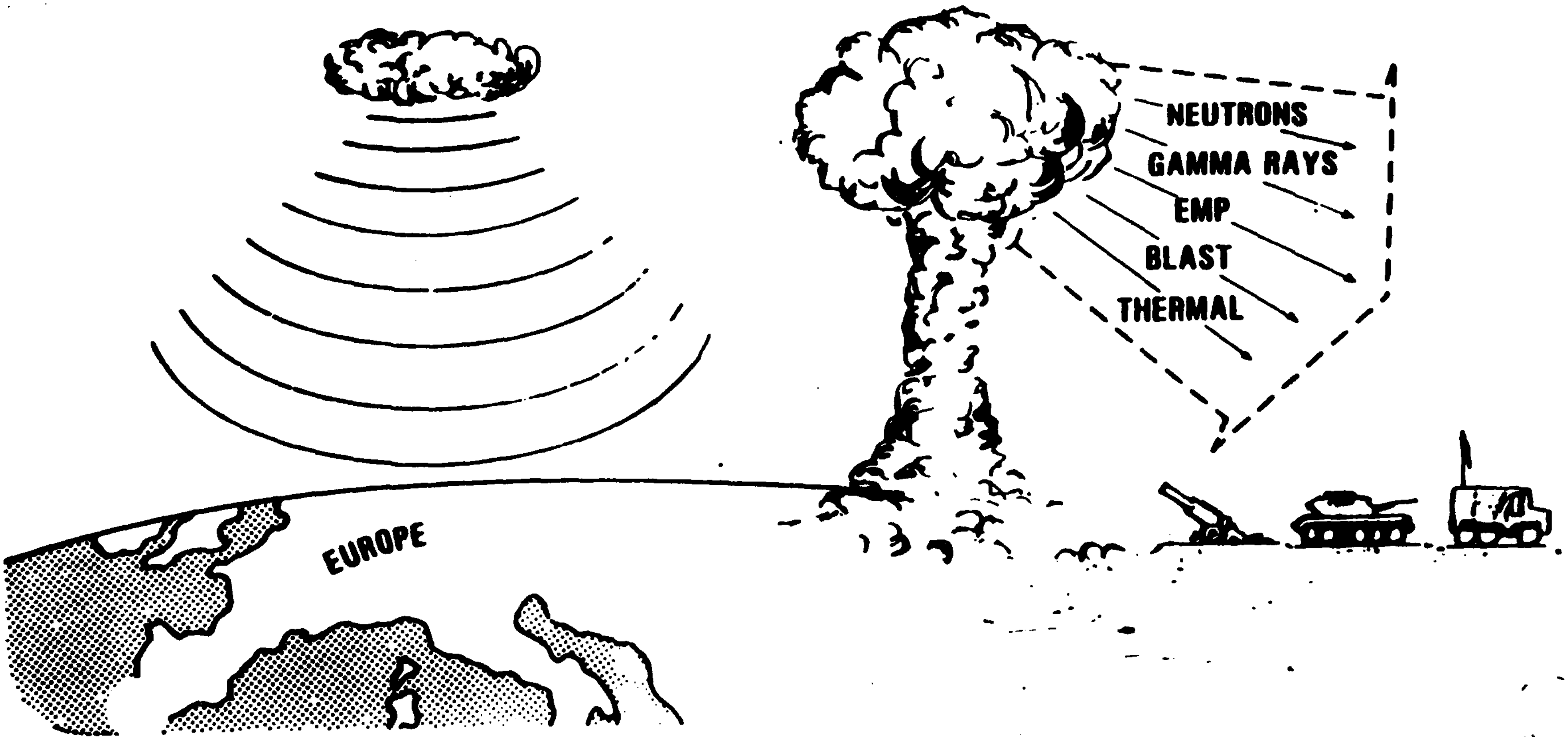
NUCLEAR SURVIVABILITY OF ARMY MATERIEL

US ARMY
LABORATORY COMMAND

NUCLEAR THREAT

HIGH ALTITUDE BURST —
ELECTROMAGNETIC PULSE (EMP)

TACTICAL THREAT —
BALANCED SURVIVABILITY



THREAT

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

HOW THE TREATY AFFECTS THE SUPERPOWERS

	UNITED STATES	SOVIET UNION
WHAT WILL BE ELIMINATED		
Deployed Missiles		
Intermediate Range (600-3,400 miles)	429	470
Short Range (300-600 miles)	0	387
Non-deployed Missiles	-	-
Intermediate Range	260	356
Short Range	170	539
TOTAL:	859	1,752

VERIFICATION PROVISIONS

- Initial inspections 60 days after the treaty enters into force.
- Close-out inspections after three years to ensure that the missiles have been destroyed.
- 20 short-notice inspections in the first three years.
- 15 short-notice inspections in the next five years.
- 10 short notice inspections in the following five years.
- U.S. inspectors to be based at a Soviet military factory in Votkinsk for 13 years.
- Soviet inspections to be based at a U.S. military factory in Utah for 13 years.

	UNITED STATES	SOVIET UNION
WHAT WILL REMAIN		
Strategic Nuclear Weapons		
Launchers	2,001	2,515
Warheads	13,002	10,595
Nonstrategic Nuclear Weapons (number of warheads)	-	-
Land-Based Battlefield Nuclear Weapons	7,073	9,043
Strategic Defensive Nuclear Warheads	-	5,100
Naval Battlefield Nuclear Weapons	3,645	2,705
TOTAL (nonstrategic)	10,718	16,848

Sources: U.S. Arms Control and Disarmament Agency and the Natural Resources Defense Council

HDL...0721-027

U.S. ARMY POLICY

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

PHILOSOPHY

- THE EQUIPMENT MUST SURVIVE IF SUFFICIENT CREW SURVIVE TO COMPLETE THE MISSION

HARRY DIAMOND LABORATORIES

US ARMY
LABORATORY COMMAND

REQUIREMENTS

DODI 4245.4

- INCLUDE NUCLEAR SURVIVABILITY IN DESIGN...OF MAJOR AND NONMAJOR SYSTEMS CRITICAL TO NUCLEAR CONFLICTS

AR 70-60

- IMPLEMENTS DODI
- MAKE MISSION-ESSENTIAL SYSTEMS SURVIVE NUCLEAR EFFECTS
- HARDEN ESSENTIAL COMPONENTS
- CONSIDER NUCLEAR SURVIVABILITY EARLY IN CONCEPT PHASE
- ESTABLISH SURVIVABILITY CRITERIA AND DEMONSTRATE SURVIVABILITY DURING DEVELOPMENT
- MANAGE NUCLEAR SURVIVABILITY THRU LIFE CYCLE
- CONSIDER SOFT FIELDED EQUIPMENT FOR RETROFIT

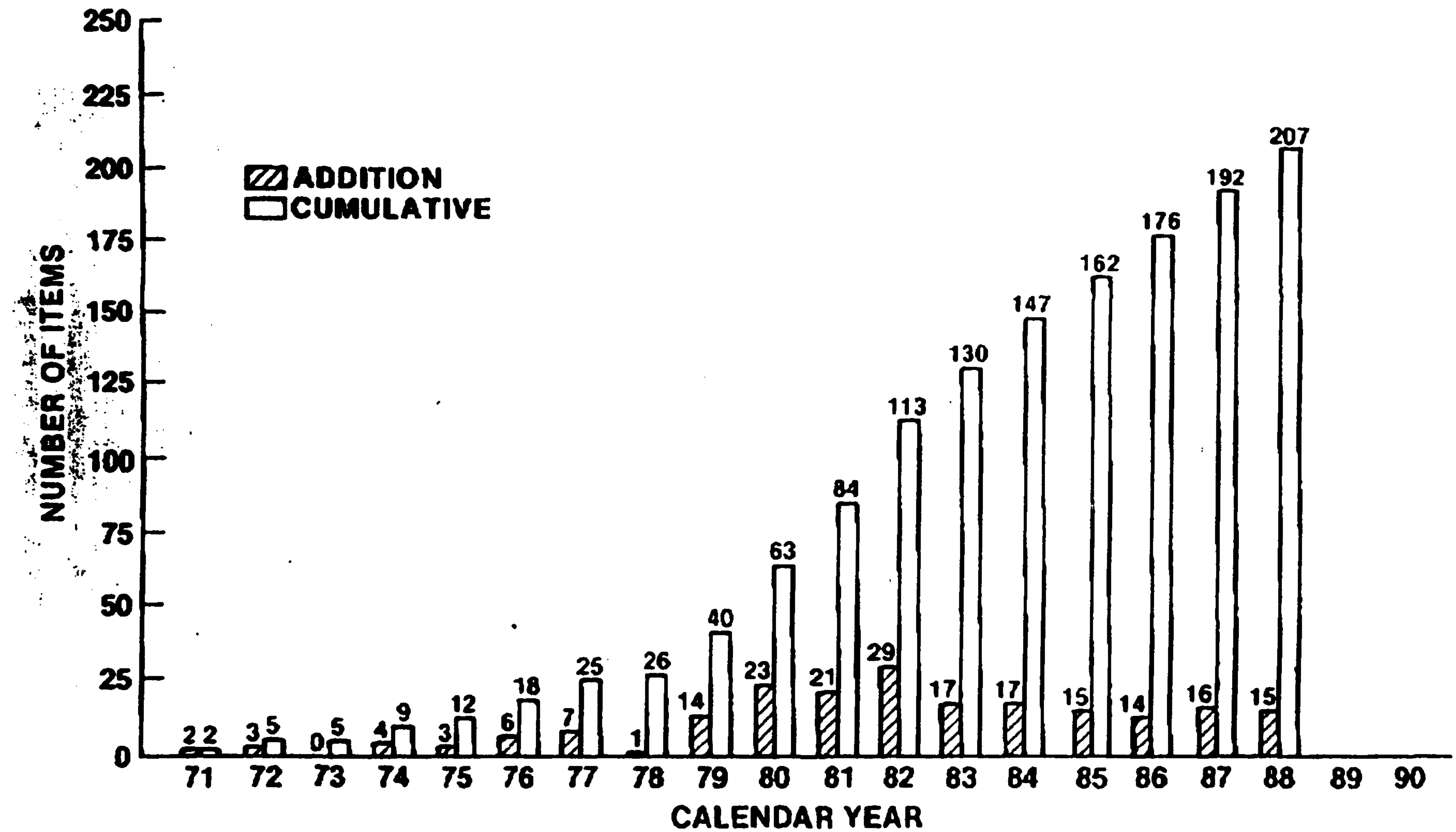
AMC SUPPLEMENT

- IMPLEMENTS AR 70-60
- HEIGHTEN AWARENESS, INTERE AND SUPPORT FOR NUCLEAR SURVIVABILITY
- DISSEMINATE INFORMATION THROUGHOUT COMMAND
- ESTABLISH MECHANISM TO REVIEW SYSTEM NUCLEAR SURVIVABILITY STATUS
- ENSURE ADEQUATE TESTING IS ACCOMPLISHED
- ESTABLISH CAPABILITY TO CONDUCT REASSESSMENT OF FIELDED SYSTEMS

SYSTEMS/EQUIPMENTS ISSUED CRITERIA

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES



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TECHNOLOGY

REQUIREMENTS

HARRY DIAMOND LABORATORIES

US ARMY
LABORATORY COMMAND

ARMY

Qualitative Research Requirements

for

NUCLEAR WEAPONS EFFECTS INFORMATION (U)

FY 89/90

FINAL EDITION

February 1988

Deputy Chief of Staff for Operations and Plans

Prepared By: U.S. Army Nuclear and Chemical Agency

NUCLEAR SURVIVABILITY PROGRAM

Technology Program Drivers

- New Threats/Next Generation Weapons
- System Life Cycle Considerations
  - Hardness, Maintenance and Surveillance
  - Integrated Logistics
- Advances in Automation and Robotics
- Commercial Products and Non-Developmental Items
- Next Generation Materials, Electronics, Photonics

PLANS DIRECTORY

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

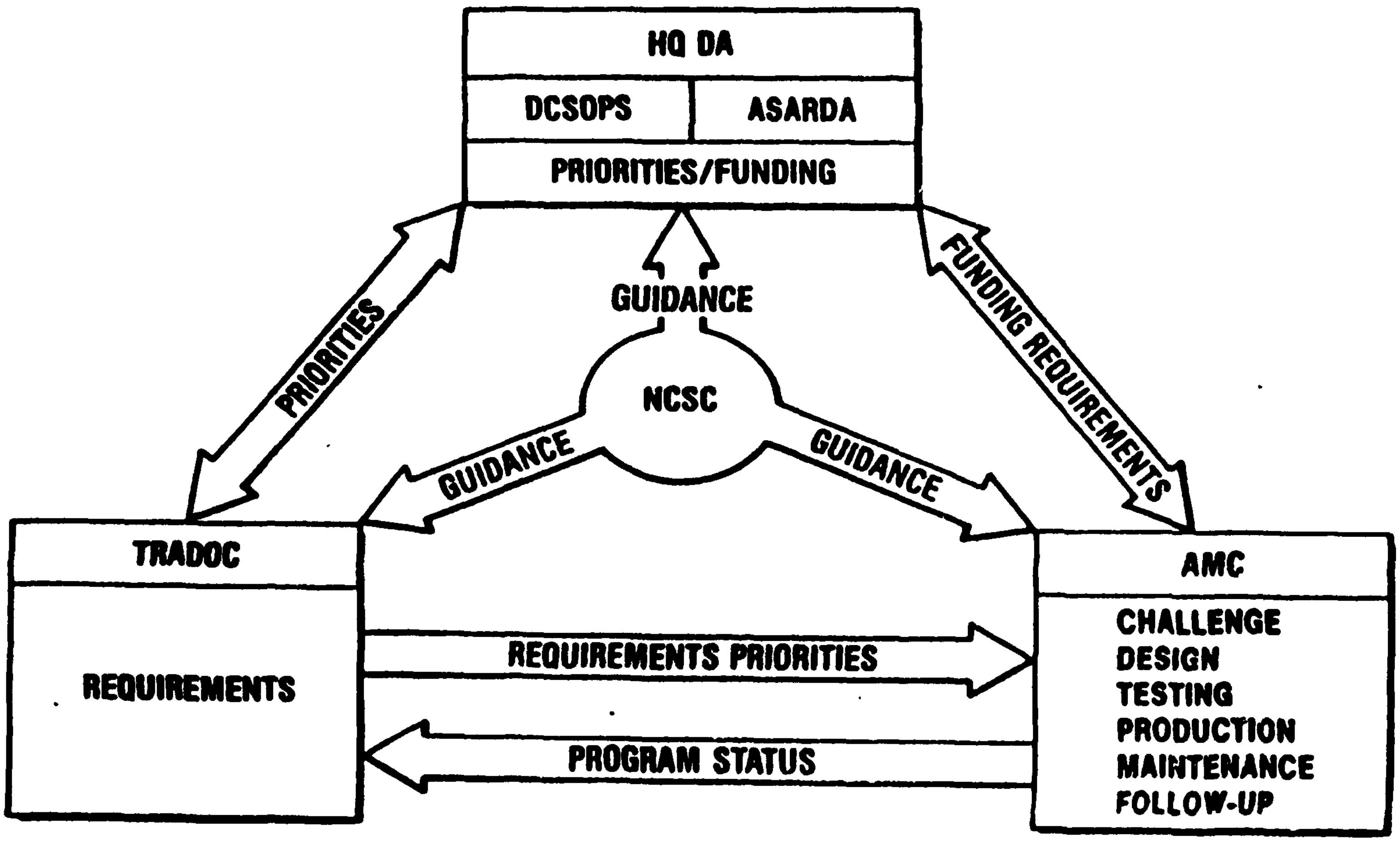
FUNDING SOURCE	HDL FUNCTIONAL AREA PLAN
DA	PIP PROGRAMS
OSD	PIF PROGRAMS SIMULATOR UPGRADES
6.3B	NUCLEAR WEAPON EFFECTS SUPPORT TEAM (NEST) FIELDED SYSTEMS
6.3A	HARDNESS ASSURANCE/HARDNESS MAINTENANCE/GENERIC ENCLOSURES NON-DEVELOPMENTAL ITEMS/ ADVANCED SYSTEMS HARDENING LARGE BLAST/THERMAL SIMULATOR (LB/TS)/TACTICAL SOURCE REGION SIMULATOR (TRS) DEFENSE STANDARDS & SPECIFICATIONS PROGRAM (DSSP)
6.2	HAEMP BLAST/THERMAL (B/T) TACTICAL SOURCE REGION (TSR)
6.1	NEW EMP ENVIRONMENTS/RADIATION EFFECTS IN SEMICONDUCTOR DEVICES
CUSTOMER PROGRAMS	

AMC
MASTER PLAN FOR NUCLEAR SURVIVABILITY

REQUIREMENTS STRATEGY FOR MANAGING THE ACQUSITION

HARRY DIAMOND LABORATORIES

US ARMY
LABORATORY COMMAND

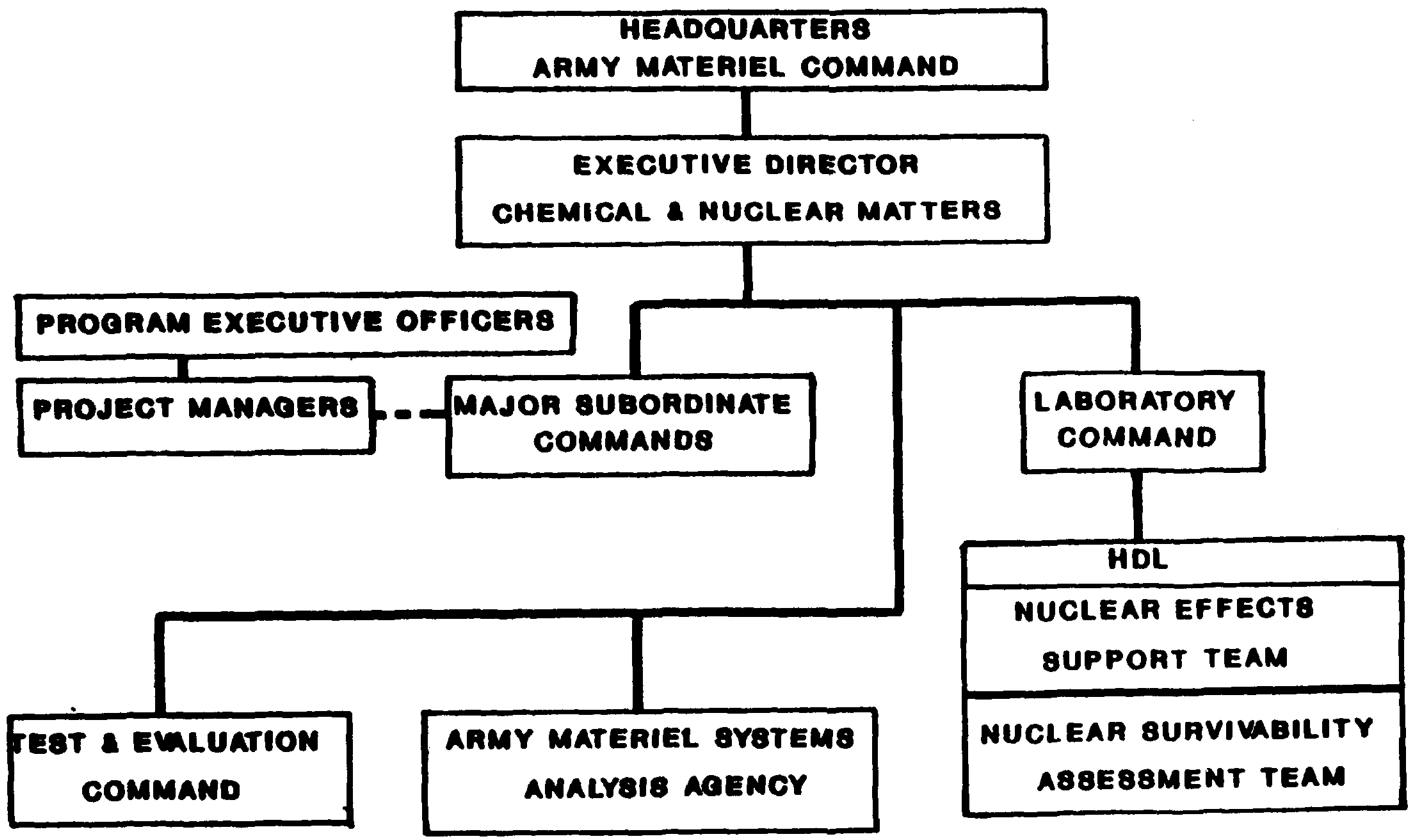


NSCS—NUCLEAR AND CHEMICAL SURVIVABILITY COMMITTEE

AMC NUCLEAR SURVIVABILITY PROGRAM

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES



NUCLEAR SURVIVABILITY TECHNOLOGY BASE INVESTMENT STRATEGY

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

EMERGING TECHNOLOGIES

- VLSI HARDENING
- FIBER OPTIC RESPONSE
- NEW LIGHTWEIGHT MATERIAL OUTRIGGERS
- HARDENED ELECTRO OPTICAL DEVICES
- ADV. HARDENING FOR FUTURE EMP THREATS
- LIGHT WEIGHT COMPOSITES
- NEW THERMAL HARDENING SOLUTIONS

CHRONIC PROBLEMS

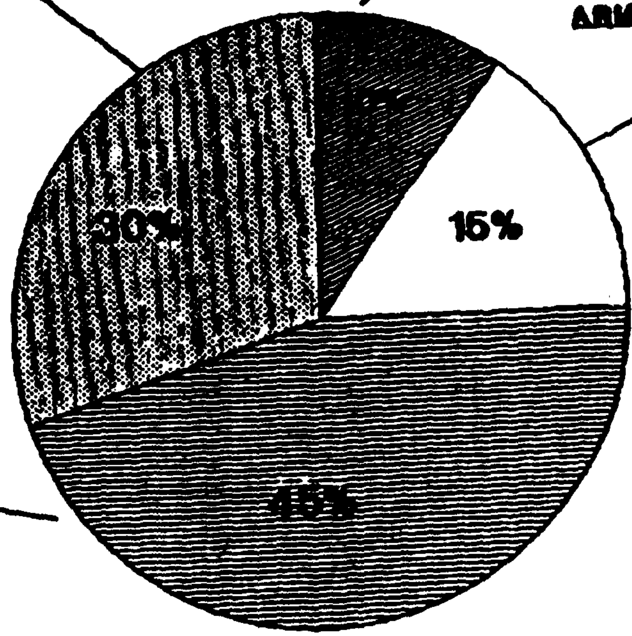
ARMY FIELDED SYSTEM PROGRAM

SUPPORTING CAPABILITY

EMP SIMULATION
- CURRENT INJECTION CAPABILITY
- AESOP UPGRADE
- INST. UPGRADE
- VEMPS-II DESIGN

BLAST/THERMAL
- LB/TS
- HE FIELD TESTS

TACTICAL SOURCE REGION
- AURORA UPGRADE
- UNDERGROUND TEST



NEXT GENERATION AND FUTURE SYSTEMS

- ADVANCED FIELD ART. SYS.
- FAAD C2I, LOSF, NLOS
- FUTURE UAV
- ADVANCED CARGO AIRCRAFT
- JAMMER 2000
- DISTRIBUTED COMMO SYSTEM
- ROBOTIC COMMAND VEHICLES
- DISTRIBUTED DATA PROCESSING SYS.
- RADARS 2000
- MSAM
- AAWS-H
- CAMM

NUCLEAR SURVIVABILITY PROGRAM

Technology Development Areas of Interest

- Effects Generation Mechanisms
  - EMP (High Altitude, Source Region, System Generated)
  - Non-ideal Blast
  - Forest Blowdown

- Coupling & Loading
  - Experimental Techniques
  - Theoretical Modeling and Validation
  - Advanced Analytical Capabilities
  - Tailored Parallel/Pipelined Processing Architectures

- Component, Subsystem and System Response
  - Testing and Test Analysis
  - Modeling and Simulation
  - Tailored Component Fabrication
  - -Database (Creation and maintenance)

- Survivability/Vulnerability Assessment
  - Standard Methodologies
  - AI Expert Assistants
  - Stocastic Modeling and Operations Research Considerations
  - Effects Synergisms

NUCLEAR SURVIVABILITY PROGRAM

Technology Development Areas of Interest
(continued)

- Hardening Capabilities
  - Advanced Materials for Blast/Thermal Protection
  - Integrated Electromagnetic Protection
  - Terminal Protection Devices
  - Electromagnetic Shielding
  - Shock Isolation
  - Radiation Hard Components
- Simulation/Instrumentation
  - Advanced EMP Simulator Designs and Components
  - LB/TS Emprovements
  - Wide Bandwidth, Large Dynamic Range Sensors

NUCLEAR SURVIVABILITY PROGRAM

Survivability Applications

- Standards and Specifications Development and Validation
- Hardness Maintenance and Surveillance Testing Demonstration
- Life Cycle Survivability Demonstrations (NG/FS)
- NDI Survivability Demonstrations
- LB/TS Product Improvements
- Next Generation EMP Simulators
- Fielded Systems Product Improvements

NUCLEAR SURVIVABILITY PROGRAM

SURVIVABILITY SUPPORT

- PEO/PM Support of Developmental Systems
- Independent Assessments of Critical Systems
- Support to DA and DoD Customers

HARRY DIAMOND LABORATORIES

US ARMY
LABORATORY COMMAND

NUCLEAR SURVIVABILITY
~~GOAL~~
SUMMARY

GOOD TECHNOLOGY BASE

GOOD MANAGEMENT/ENGINEERING
PRACTICES AT THE PM LEVEL

COST-EFFECTIVE
APPROACH FOR PROVIDING
NUCLEAR SURVIVABLE EQUIPMENT
FOR THE MODERN INTEGRATED BATTLEFIELD

NUCLEAR SURVIVABILITY TECHNOLOGY

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

6.2 TECHNOLOGY DEVELOPMENT

- ELECTROMAGNETIC PULSE
- TACTICAL SOURCE REGION
- BLAST/THERMAL
- HARDENED ELECTRONICS

PROJECTED FUNDING: $ IN MILLIONS

FY91	FY92	FY93	FY94	FY95	FY96
9.2	13.1	14.4	15.3	15.3	15.3

Rec'd 6 Dec 8[illegible]

NUCLEAR SURVIVABILITY TECHNOLOGY

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

6.2 TECHNOLOGY DEVELOPMENT

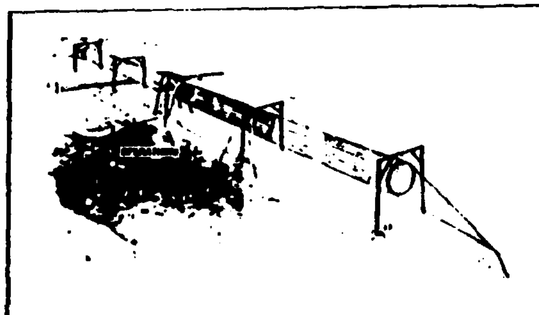
- ELECTROMAGNETIC PULSE
- TACTICAL SOURCE REGION
- BLAST/THERMAL
- HARDENED ELECTRONICS

Harry Diamond Laboratories — US Army Laboratory Command

ELECTROMAGNETIC PULSE EFFECTS PROGRAM

OBJECTIVE

- DEVELOP TECHNOLOGY TO HARDEN ARMY TACTICAL SYSTEMS TO HIGH ALTITUDE BURST ELECTROMAGNETIC PULSE EFFECTS
- MAINTAIN STRONG ANALYTIC AND EXPERIMENTAL CAPABILITIES TO VERIFY SYSTEM HARDNESS TO HAEMP



AESOP—HDL WOODBRIDGE

PROGRAM MILESTONES

- DIRECT DRIVE FACILITY FOR NON-RADIATING EMP SIMULATION
- RELOCATION OF RADIATING EMP SIMULATORS
- TERMINAL PROTECTION DEVICE DEVELOPMENT
- ISOLATION TRANSFORMER DEVELOPMENT
- NEW ANALYTIC TECHNIQUES FOR CALCULATING SYSTEM COUPLING
- DEDICATED MICROCOMPUTER FOR ADVANCED EMP CALCULATIONS

EMP HARDENING TECHNOLOGY

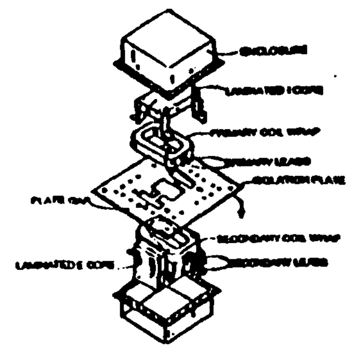
US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

OBJECTIVE

PROVIDE THE THEORETICAL, EXPERIMENTAL, AND INSTRUMENTAL MEANS TO HARDEN ARMY TACTICAL EQUIPMENT AGAINST HEMP
- ANALYTIC ALGORITHMS
- TERMINAL PROTECTION DEVICES
- ISOLATION POWER TRANSFORMERS
- DEVICE DAMAGE CHARACTERIZATION
- MODERN TEST MAINTENANCE AND DIAGNOSTIC EQUIPMENT

15 KVA ISOLATION TRANSFORMER



POTENTIAL CONTRACT SUPPORT

- DAMAGE ANALYSIS
- DEVICE AND TRANSFORMER DEVELOPMENT
- SEMICONDUCTOR DAMAGE CHARACTERIZATION
- TEST EQUIPMENT

PROGRAM MILESTONES

- TERMINAL PROTECTION DEVICE DEVELOPMENT
- ISOLATION TRANSFORMER DEVELOPMENT
- EXPLOITATION OF FOREIGN TECHNOLOGY

CURRENT INJECTION SIMULATION

US ARMY
LABORATORY COMMAND

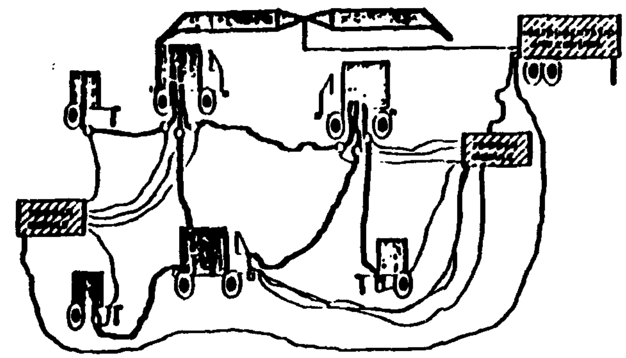
HARRY DIAMOND LABORATORIES

OBJECTIVE

DEVELOP HARDWARE AND ANALYTICAL TECHNIQUES CAPABLE OF NON-RADIATING EMP TESTING OF GENERAL TACTICAL SYSTEMS

- EVALUATE HARDENING APPROACHES
- DEMONSTRATE OVERALL SYSTEM HARDNESS
- LIFE CYCLE HARDNESS SURVEILLANCE

SYNCHRONOUS INJECTION SYSTEM



POTENTIAL CONTRACT SUPPORT

- COUPLING ANALYSIS AND TESTS
- DRIVER DESIGN

PROGRAM MILESTONES

- DIRECT-DRIVE FACILITY SYSTEM REQUIREMENTS
- SYSTEM DESIGN AND PROTOTYPE DEVELOPMENT
- FACILITY DEVELOPMENT
- ACCEPTANCE TESTING

EMP SIMULATION

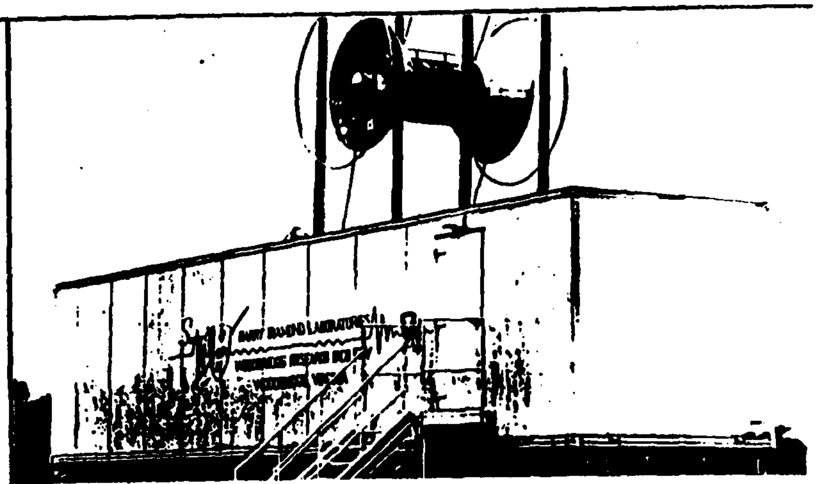
US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

OBJECTIVE

OPERATE, MAINTAIN, AND UPGRADE THE ARMY'S RESEARCH AND DEVELOPMENT HIGH ALTITUDE ELECTROMAGNETIC PULSE (EMP) SIMULATION FACILITY ASSETS.

RELOCATE HIGH POWER RADIATING EMP SIMULATORS TO THE WESTERN U.S.



AESOP FACILITY

POTENTIAL CONTRACT SUPPORT

- SCALE MODEL FACILITY IMPROVEMENT
- INSTRUMENTATION
- SIMULATOR RELOCATION
- COMPLETE FABRICATION AND INSTALLATION OF VEMPS II

PROGRAM MILESTONES

- AESOP FACILITY RELOCATION
- CONTINUOUS WAVE FACILITY OPERATION
- IVAN II FACILITY OPERATION
- SCALE MODEL FACILITY OPERATION
- DEVELOPMENT OF VEMPS II FACILITY FOR DEPLOYMENT IN WESTERN U.S.

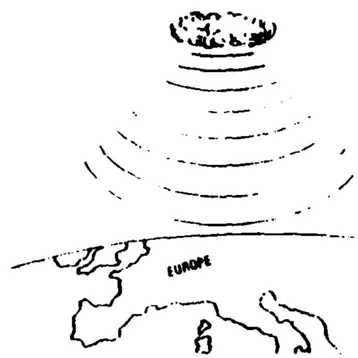
EMP COUPLING AND ANALYSIS

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

OBJECTIVE

- DEVELOP ANALYTIC TECHNIQUES TO IMPROVE CAPABILITY FOR HARDENING SYSTEMS TO HIGH ALTITUDE BURST EMP
- REFINE CALCULATIONAL TECHNIQUES FOR DETERMINING EMP COUPLING AND SHIELDING



POTENTIAL CONTRACT SUPPORT

- COMPLETE THE DEFINITION OF THE E2 AND E3 WAVEFORMS FOR DOD-STD-2169
- IMPROVED EMP SHIELDING METHODS
- COUPLING ANALYSIS METHODS

PROGRAM MILESTONES

- DEFINE EMP ENVIRONMENTS PRODUCED BY NEW WEAPONS
- NEW ANALYTIC TECHNIQUES FOR CALCULATING SYSTEM COUPLING
- DEDICATED MINICOMPUTER FOR ADVANCED EMP CALCULATIONS
- EMP SHIELDING GUIDELINES

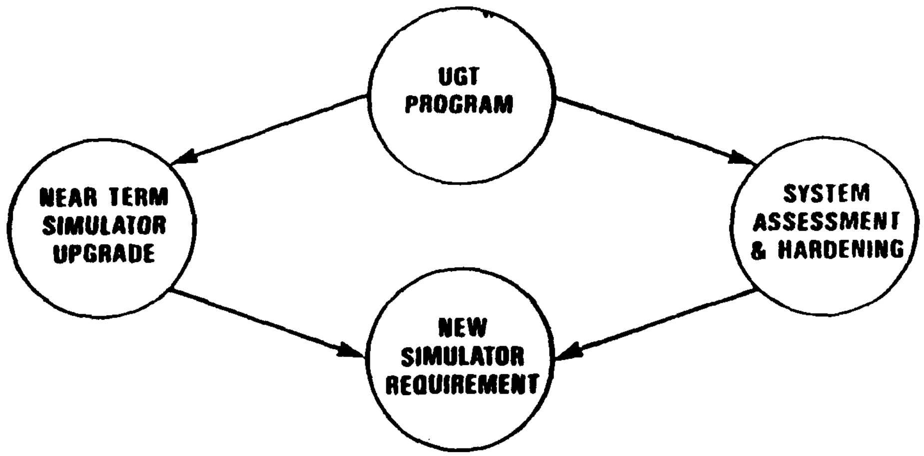
HARRY DIAMOND LABORATORIES

TACTICAL SOURCE REGION PROGRAM

US ARMY
LABORATORY COMMAND

OBJECTIVE

DEVELOP TECHNOLOGY TO HARDEN ARMY TACTICAL SYSTEMS TO THE SOURCE REGION EMP THREAT USING ABOVE GROUND TEST FACILITIES AND ANALYTIC CAPABILITY.



PROGRAM MILESTONES

- ABOVE GROUND TEST PROGRAM AND AURORA UPGRADE
- UNDERGROUND TEST TO VERIFY TACTICAL SOURCE REGION THREAT
- TSR HARDENING GUIDELINES
- NEW TSR SIMULATOR AVAILABLE FOR SYSTEM TESTING

UNDERGROUND TEST PROGRAM

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

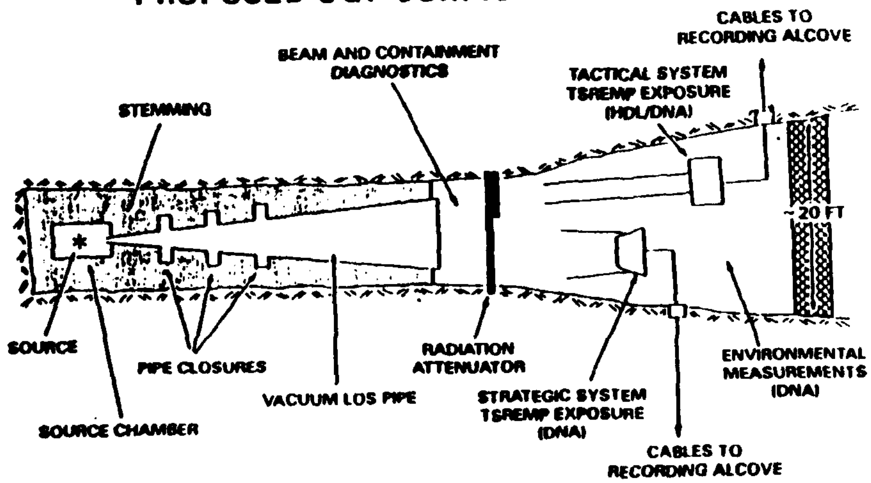
OBJECTIVE

•VALIDATE ANALYTICAL AND ABOVE GROUND EXPERIMENTAL TACTICAL SOURCE REGION SIMULATION

•VALIDATE TACTICAL SOURCE REGION HARDENING PROCEDURES

•GENERATE A DATABASE FOR A TACTICAL SOURCE REGION SIMULATOR DESIGN

PROPOSED UGT CONFIGURATION



POTENTIAL CONTRACT SUPPORT

- HARDWARE FABRICATION
- ANALYSES AND RESPONSE PREDICTIONS
- TEST PLANNING
- SYSTEM TESTS AT SIMULATORS
- UNDERGROUND NUCLEAR TESTING

PROGRAM MILESTONES

•SYSTEM RESPONSE PREDICTIONS

•PRELIMINARY SGEMP HARDENING GUIDELINES

•ABOVE GROUND TESTS TO VERIFY ANALYTIC PREDICTIVE TECHNIQUES AND ESTABLISH VALIDATION PROCEDURES

•UNDERGROUND TEST TO VERIFY THE ABILITY OF ABOVE GROUND TESTING AND ANALYSIS TO VALIDATE THE HARDNESS OF ARMY SYSTEMS

HARRY DIAMOND LABORATORIES

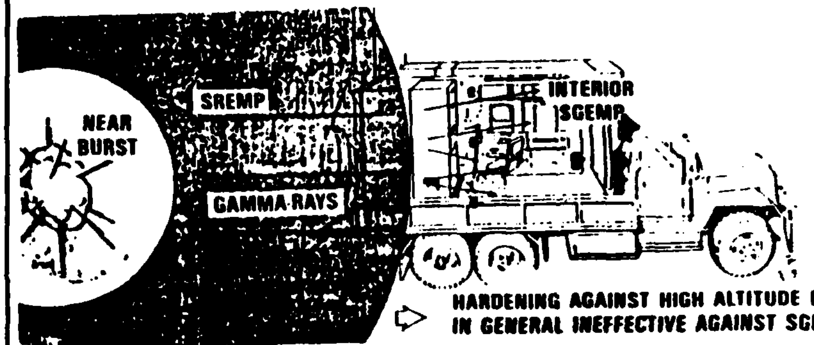
US ARMY
LABORATORY COMMAND

SREMP/SGEMP SIMULATION

OBJECTIVE

- DEVELOP A CAPABILITY FOR EFFECTIVE SIMULATION OF THE SREMP/SGEMP THREAT ON THE TACTICAL BATTLEFIELD.
- PROVIDE RADIATION HARDNESS ASSURANCE FOR ARMY TACTICAL SYSTEMS.

TACTICAL SOURCE REGION EFFECTS



HARDENING AGAINST HIGH ALTITUDE EMP IS IN GENERAL INEFFECTIVE AGAINST SGEMP

POTENTIAL CONTRACT SUPPORT

- SIMULATOR DESIGN STUDIES
- PULSE POWER COMPONENTS
- TEST SUPPORT

PROGRAM MILESTONES

- AURORA RISETIME REDUCED FROM 50NS TO 10NS; PULSE WIDTH REDUCED TO 30NS
- TACTICAL SREMP ENVIRONMENT SIMULATED INSIDE COMMUNICATIONS SHELTER
- FOUR AURORA DRIFT TUBES OPTIMIZED TO INCREASE OUTPUT AND UNIFORMITY; DECREASE RISETIME FOR SCALE MODELING
- VALIDATE ANTENNA AND CABLE COUPLING CODES

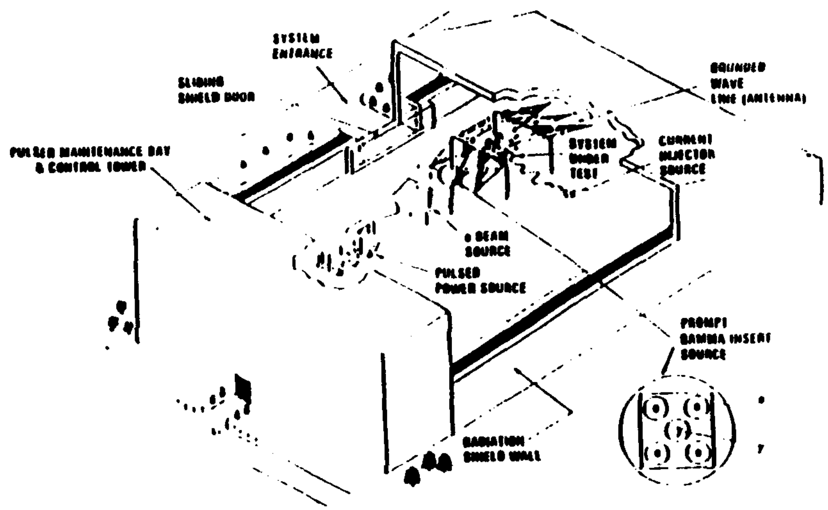
TACTICAL SOURCE REGION SIMULATOR

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

OBJECTIVE

- PROVIDE A COST EFFECTIVE SREMP/SGEMP TESTING CAPABILITY FOR ARMY TACTICAL SYSTEMS
- SREMP PHENOMENOLOGY TEST BED
- PROVIDE RADIATION HARDNESS ASSURANCE



POTENTIAL CONTRACT SUPPORT

- SIMULATOR DESIGN
- ENVIRONMENTAL STUDIES
- PULSE POWER COMPONENTS
- FACILITY CONTROLS AND INSTRUMENTATION

PROGRAM MILESTONES

INTERIM TEST CAPABILITY AT AURORA
- LOW JITTER SWITCHES
- ELECTRON BEAM DRIFT TUBES
- MIXED GAMMA AND ELECTRON ENVIRONMENT

NEW TSR SIMULATION FACILITY
- TEST 100 ARMY SYSTEMS TO THEIR TSR SPECIFICATIONS

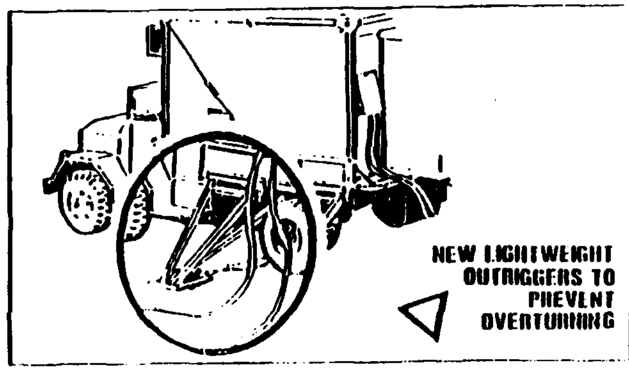
BLAST/THERMAL EFFECTS PROGRAM

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

OBJECTIVE

- DEVELOP TECHNOLOGY TO HARDEN ARMY TACTICAL SYSTEMS TO NUCLEAR BLAST AND THERMAL EFFECTS
- IMPROVE AND MAINTAIN SIMULATION AND MODELING CAPABILITIES TO DESIGN AND TEST HARDENED SYSTEMS



OVERTURN PROTECTION

PROGRAM MILESTONES

- HIGH EXPLOSIVE TESTS
- 1/6 SCALE TEST BED FOR LARGE BLAST/THERMAL SIMULATOR
- BLAST OVERTURN PROTECTION DEVICES
- FOREST BLOWDOWN AND FIRE HAZARD
- NON-IDEAL BLAST SIMULATION

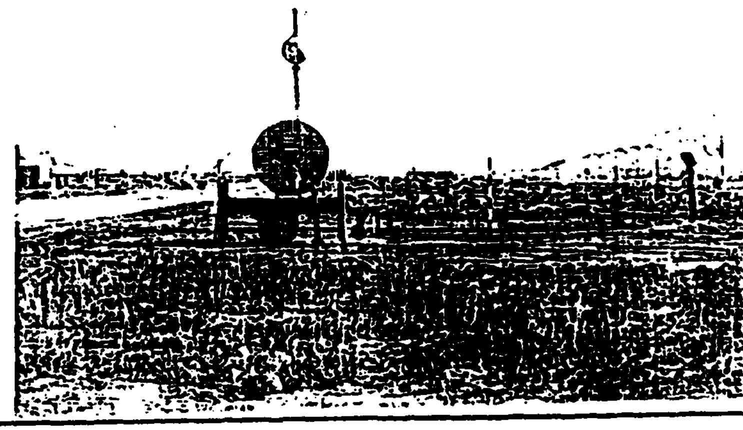
BLAST/THERMAL HARDENING TECHNOLOGY

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

OBJECTIVE

- DETERMINE VULNERABILITY LIMITS OF TACTICAL ARMY SYSTEMS/SUBSYSTEMS
- RECOMMEND HARDENING AND SHIELDING SOLUTIONS FOR BLAST, THERMAL AND RELATED EFFECTS



POTENTIAL CONTRACT SUPPORT

- ANALYSES AND TESTS
- MATERIAL EVALUATIONS
- EQUIPMENT DESIGN
- HARDENING GUIDELINES

PROGRAM MILESTONES

- DAMAGE ASSESSMENTS
- BLAST/THERMAL HARDENED SHELTER
- BLAST OVERTUTN PROTECTION DEVICES
- SHOCK ISOLATION METHODS
- THERMAL PROTECTIVE COATINGS
- PIP PROGRAM ON MOBILE ELECTRIC POWER

1/6 SCALE TEST BED FOR LARGE BLAST/THERMAL SIMULATOR

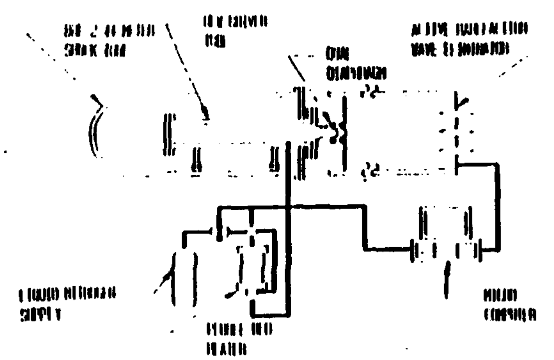
US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

OBJECTIVE

- DEVELOP A TEST BED FOR SCALED TESTING OF CRITICAL DESIGN ELEMENTS FOR THE LB/TS 65% DESIGN
- IMPROVE BLAST/THERMAL SIMULATION CAPABILITY FOR SMALL ARMY SYSTEMS

LARGE SCALE LB/TS TEST BED



POTENTIAL CONTRACT SUPPORT

- HARDWARE FABRICATION
- INSTRUMENTATION
- ANALYTICAL STUDIES
- TEST SUPPORT

PROGRAM MILESTONES

- TEST DRIVER SYSTEM
  - PEBBLE BED HEATER
  - DOUBLE DIAPHRAGM SYSTEM
- PROTOTYPE RAREFACTION WAVE ELIMINATOR
- THROAT VALVE EVALUATION
- INERTIAL REFERENCE SYSTEM PROTOTYPE
- LB/TS PERFORMANCE CHARACTERIZATION
- LIFE CYCLE SUPPORT FOR LB/TS OPERATION AND IMPROVEMENT

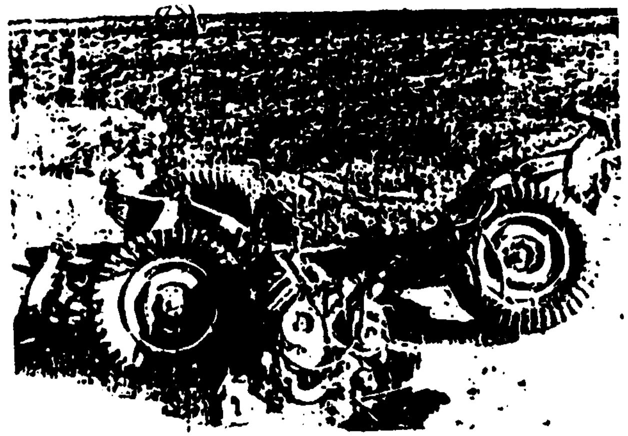
HARRY DIAMOND LABORATORIES

US ARMY LABORATORY COMMAND

NON-IDEAL BLAST SIMULATION

OBJECTIVE

- CHARACTERIZE NON-IDEAL BLAST/THERMAL PHENOMENOLOGY FOR TACTICAL ARMY SYSTEMS
- DETERMINE INCREASE IN VULNERABILITY RADIUS FOR TACTICAL ARMY SYSTEMS



NON-IDEAL BLAST
(2-4 TIMES THE LOAD)

POTENTIAL CONTRACT SUPPORT

- ANALYSES AND TESTS
- FLUID DYNAMICS STUDIES
- SIMULATOR DESIGN CALCULATIONS
- SYSTEM RESPONSE ANALYSES

PROGRAM MILESTONES

- DETERMINE INCREASED VULNERABILITY RADIUS
- INCORPORATE NON-IDEAL TESTING CAPABILITY INTO LB/TS TEST BED
- INCORPORATE NON-IDEAL BLAST EFFECTS INTO LB/TS FACILITY
- CHARACTERIZE LIMITS OF LB/TS NON-IDEAL PERFORMANCE

FOREST BLOWDOWN

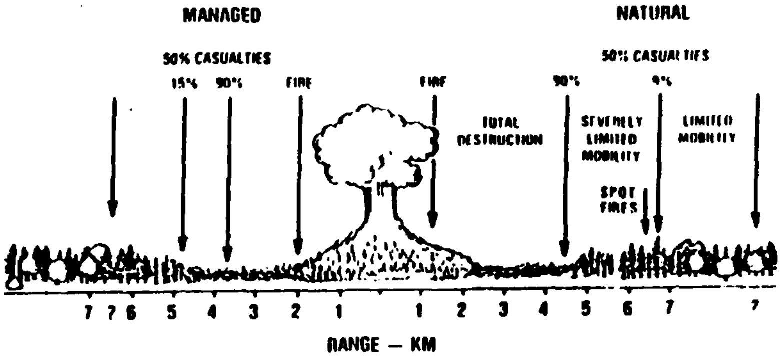
US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

OBJECTIVE

- CHARACTERIZE PHYSICAL PHENOMENOLOGY OF TREE AND DEBRIS TRANSPORT
- DEVELOP COMPUTERIZED PREDICTIVE METHODOLOGY
- INCORPORATE INTO EFFECT MANUAL FOR FIELD APPLICATION

REPRESENTATIVE FOREST DAMAGE
300KT SOURCE



POTENTIAL CONTRACT SUPPORT

- DATA ON TREE CHARACTERISTICS
- TEST SUPPORT
- SYSTEM DAMAGE ANALYSIS
- FOREST FIRE MODELS

PROGRAM MILESTONES

- MISERS GOLD EXPERIMENT
  - STEM FRACTURE ANALYSIS
  - DEBRIS LETHALITY
  - CLUSTER EFFECTS
- MOBILITY IMPAIRMENT STUDIES
- LETHALITY OF DEBRIS ON ARMY EQUIPMENT
- LIVE FOREST EXPERIMENT (1KT AT HOB)
- FIRE SPREAD PREDICTION METHODS

EMERGING TECHNOLOGIES

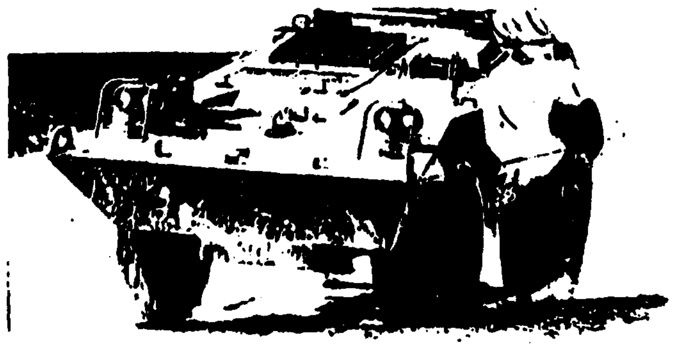
US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

OBJECTIVE

DETERMINE THE EFFECTS OF THE TACTICAL NUCLEAR RADIATION ENVIRONMENT ON EMERGING/ ADVANCED TECHNOLOGIES AND TO MAKE RECOMMENDATIONS ON ENHANCING SURVIVABILITY

- COMPOSITE MATERIALS
- MICROELECTRONICS
- FIBER OPTICS/ELECTRO-OPTICS
- ROBOTICS
- SENSORS
- COMPUTERS
- COMMUNICATION



POTENTIAL CONTRACT SUPPORT

- COMPONENT RESPONSE DATA
- HARDENING METHODS
- SYSTEM AND EQUIPMENT HARDNESS ESTIMATES
- OPERATIONS RESEARCH

PROGRAM MILESTONES

- ADVANCED HARDENED MICROELECTRONICS TESTING PROCEDURES
- CCD/CID IMAGING DETECTOR RESPONSE TO NUCLEAR RADIATION
- SURVIVABILITY ENHANCEMENTS FOR ROBOTIC SYSTEMS
- FIGHTING UNIT SURVIVABILITY EVALUATION

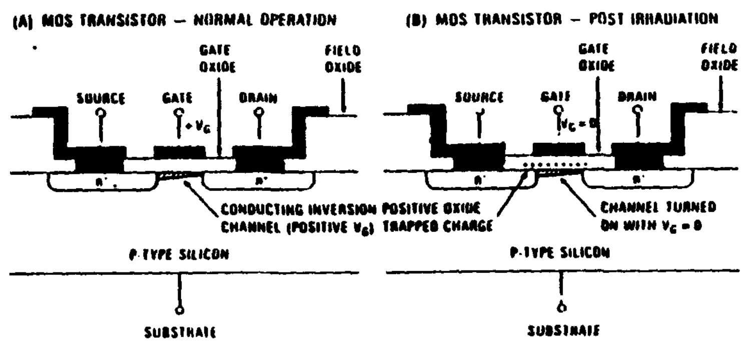
6.1 RADIATION SPECIAL EFFECTS

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

OBJECTIVE

- UNDERSTAND TIME-DEPENDENT RADIATION RESPONSE OF MICROELECTRONIC CIRCUITS.
- DEVELOP THIN FILM FERROELECTRIC TECHNOLOGY FOR RADIATION RESISTANT NON VOLATILE MEMORIES FOR MISSILE AND SPACE APPLICATIONS.
- CORRECT UNCERTAINTY IN EMP PREDICTION CAPABILITIES DUE FOR EXAMPLE TO AIR CONDUCTIVITY/ELECTRON MOBILITY INACCURACIES.



POTENTIAL CONTRACT SUPPORT

- BASIC PHYSICS MECHANISMS
- COMPONENT RESPONSE DATA

PROGRAM MILESTONES

- RADIATION PROBLEMS IN BURIED OXIDES AND TRENCHES FOR ISOLATION BETWEEN TRANSISTORS
- POLARIZABILITY, RETENTION, AND ENDURANCE PROPERTIES OF THIN FERROELECTRIC FILMS
- MODELS FOR CHARGING GRAIN BOUNDARIES IN FERROELECTRICS TO PREDICT FILM DEGRADATION
- MODEL FOR TIME DEPENDENT DISTRIBUTION FUNCTION FOR ELECTRON MOBILITIES

NUCLEAR EFFECTS SUPPORT

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

6.3B SYSTEM DEVELOPMENT SUPPORT

- NUCLEAR EFFECTS SUPPORT TEAM
- NUCLEAR SURVIVABILITY ASSESSMENT TEAM
- NUCLEAR SURVIVABILITY OF FIELDED SYSTEMS

PROJECTED FUNDING: $ IN MILLIONS

FY91	FY92	FY93	FY94	FY95	FY96
2.2	2.2	2.2	2.2	2.2	2.2

HARRY DIAMOND LABORATORIES

NUCLEAR EFFECTS SUPPORT

US ARMY LABORATORY COMMAND

6.3B SYSTEM DEVELOPMENT SUPPORT

- NUCLEAR EFFECTS SUPPORT TEAM
- NUCLEAR SURVIVABILITY ASSESSMENT TEAM
- NUCLEAR SURVIVABILITY OF FIELDED SYSTEMS

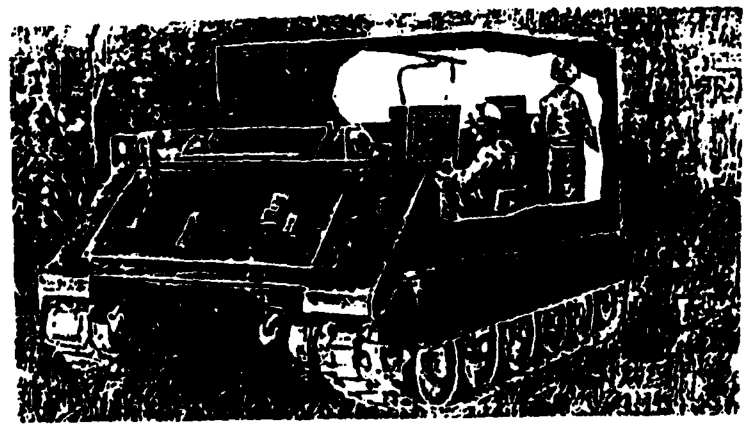
6.3b NUCLEAR EFFECTS SUPPORT TEAM

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

OBJECTIVE

PROVIDE AD HOC NUCLEAR SURVIVABILITY TECHNICAL AND MANAGEMENT SUPPORT TO MATERIEL DEVELOPERS AND THEIR CONTRACTORS THROUGHOUT THE MATERIEL ACQUISITION LIFE CYCLE



BATTERY COMPUTER SYSTEM

POTENTIAL CONTRACT SUPPORT

- AD HOC TEAM MEMBERS
- SYSTEM HARDENING
- EXPERT SYSTEM DEVELOPMENT

PROGRAM MILESTONES

- HARDENING STRATEGY FOR NEXT GENERATION AND FUTURE SYSTEMS (HFM, GBCS, SASS)
- HARDNESS MAINTENANCE/SURVEILLANCE TECHNOLOGY TRANSFER
- HARDNESS AWARENESS COURSE FOR MSC/RDEC ADVISORS
- COMPLETE PROTOTYPE EXPERT SYSTEMS MANAGEMENT SUPPORT FOR MATERIEL DEVELOPERS

NUCLEAR EFFECTS SUPPORT TEAM FUNCTIONS

US ARMY
LABORATORY COMMAND
HARRY DIAMOND LABS

ADVISES AND ASSISTS IN:

- MANAGEMENT AND TECHNICAL GUIDANCE
- REQUEST FOR PROPOSAL FORMULATION
- PRE-BIDDERS CONFERENCES
- SOURCE SELECTION EVALUATION BOARDS
- CONTRACT NEGOTIATIONS
- TEST INTEGRATION WORKING GROUPS
- CONTRACTOR REVIEWS

6.3b NUCLEAR SURVIVABILITY ASSESSMENT TEAM

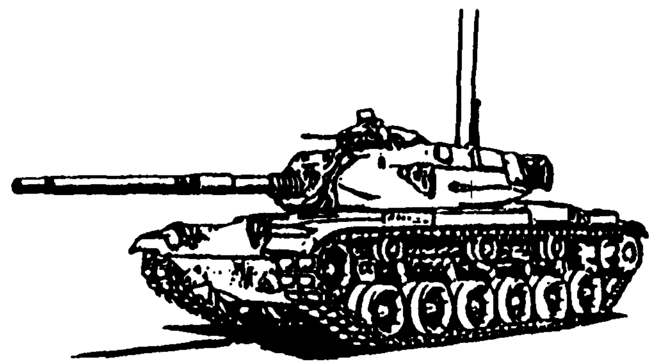
US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

OBJECTIVE

- SUPPORT AMC IN MANAGEMENT OF THE NUCLEAR SURVIVABILITY PROGRAM
- CONDUCT INDEPENDENT TECHNICAL EVALUATIONS OF NUCLEAR SURVIVABILITY PROGRAMS AS DIRECTED BY AMC
- COORDINATE THE NUCLEAR SURVIVABILITY PROGRAM INSIDE AND OUTSIDE OF AMC

M60A3 TANK BATTALION



POTENTIAL CONTRACT SUPPORT

- SYSTEM AND EQUIPMENT ASSESSMENTS
- DATA COLLECTION AND MANAGEMENT

PROGRAM MILESTONES

- INR TESTING OF QRG'S (5KW AND 30KW)
- INR TESTING OF SCOTT 3KW GENERATOR SET
- SERVED ON SAG FOR COEA PROTOCOL REPORT
- RESTRUCTURE PROGRAM FOR ASSESSING FIELDED SYSTEMS
- CONTINUE ASSESSMENTS
- ENTER SURVIVABILITY DATA INTO DATA BASE

6.3b NUCLEAR SURVIVABILITY OF FIELDED SYSTEMS

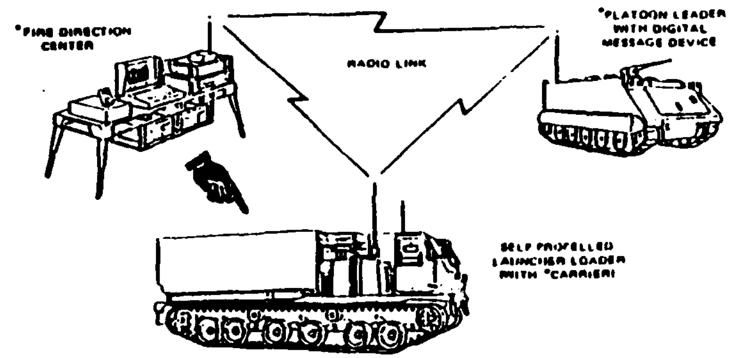
US ARMY LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

OBJECTIVE

- ASSESS NUCLEAR SURVIVABILITY OF FIELDED SYSTEMS IN PRIORITY ORDER ESTABLISHED BY HQ TRADOC
- IDENTIFY HARDENING REQUIREMENTS
- RECOMMEND PRODUCT IMPROVEMENTS
- MAINTAIN NUCLEAR SURVIVABILITY DATABASE FOR TACTICAL ARMY EQUIPMENT

MLRS SYSTEM



POTENTIAL CONTRACT SUPPORT

- SYSTEM SURVIVABILITY ASSESSMENTS
- HARDENING RECOMMENDATIONS

PROGRAM MILESTONES

FY86-FY89 ASSESSMENTS:

- M1 BATTALION
- FIRE CONTROL C3
- 4 INFANTRY BATTALIONS
- MLRS BATTERY
- LANCE BATTERY
- M60 BATTALION
- M109 BATTALION
- PATRIOT

FY89 - RESTRUCTURE PROGRAM FOR CONTINUATION

FY90-FY91 - DEVELOP HARDENING REQUIREMENTS

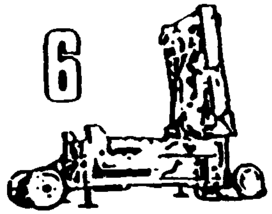
NUCLEAR SURVIVABILITY ASSESSMENTS

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

M109 HOWITZER

6

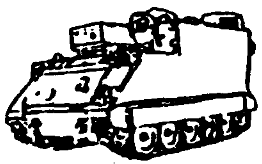


OTHER SUPPORT EQUIPMENT
- Survey - Pads
- Radar - Q36/Q37
- AM Radio Sets
- HEMTT
  - Cargo
  - Fuel
- Trucks
  - CUCV
  - HMMWV
  - 2 1/2 T
  - 5 T
- Trailers
- TACMS (Tac Army CSS Computer Sys)

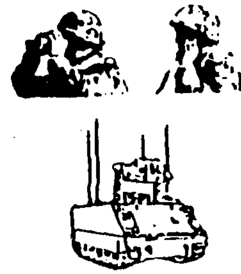
1

CANNON BATTERIES
- M109 Howitzer & Ammunition
- M992 FAASV/M548 Cargo Carrier
- M578 Recovery Vehicle
- AN/PVS-5/AN-TVS-5 Night Vision Devices
- AN/PRC-68 SUT
- Gun Display Unit

2



BATTERY FDC
- M577 CP Carrier
- GYK-29 BCS
- Backup Computer Sys
- Radios, Antennas, & Mounts



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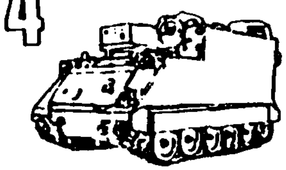
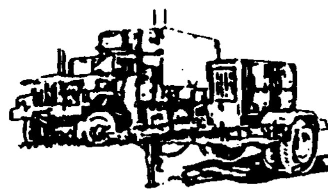
MVR CO FIST
- M981 FISTV
- DMD
- GLLD
- Radios
- Generators

4



MVR BN/BDE FSO
- M577 CP Carrier
- VFMED
- Radios



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FA BATTALION TACFIRE
- GSG-10V TACFIRE
- Radios, Antennas & Mounts
  - AN/VRC 12
  - AN/VRC 125
- Speech Secure Equipment
- 5 Ton Trucks

EXTERNAL SUPPORT

ORDNANCE
- Ammo
- Maintenance

TRANSPORTATION
- Resupply

QUARTERMASTER
- Logistics

DIVARTY ASSETS
- Met Data

PROGRAM MANAGER SUPPORT

FY88 ACCOMPLISHMENTS

- SOURCE SELECTION/EVALUATION BOARD (MELIOS, TACJAM, ACCS, FAAD NLOS)
- HARDNESS TESTING (OG-174, AJCM, SCOTT 3KW GENERATOR, M749 FUZE COMPONENTS, FORKLIFT TRUCK)
- NUCLEAR SURVIVABILITY ASSESSMENTS (HAB, SCOTT 3KW GENERATOR, QUIET RELIABLE GENERATOR SETS)
- JOINT SERVICES PROGRAM SUPPORT (JSTARS, DWTS, CSCE, JTIDS, V-22 OSPREY)
- HARDNESS ASSURANCE/HARDNESS MAINTENANCE STRATEGY (SINCGARS, CAWS/MAPS, SADARM, JSTARS SST, CSCE)

FY89 STATUS

- SOURCE SELECTION/EVALUATION BOARD (AAWS-M, NBCRS, IRV, HAIDE-II, LAMS, JSTARS)
- HARDNESS TESTING (QUIET RELIABLE GENERATOR SET, FORKLIFT TRUCK, SINCGARS, VEMASID, SCOTT 3KW GENERATOR, M749 FUZE)
- NUCLEAR SURVIVABILITY ASSESSMENTS (FOTL, GBCS, EFVS, QUIET RELIABLE GENERATOR SETS, TDFD)
- INITIATE JOINT AMC/TRADOC INVESTIGATION OF SURVIVABILITY ALTERNATIVES
- INITIATE JOINT DNA/HDL EXPERT SYSTEMS MANAGEMENT SUPPORT FOR DEVELOPERS
- LIFE CYCLE NUCLEAR SURVIVABILITY STRATEGY (AFV, SINCGARS, JSTARS, FOTL, HAIDE-II, SADARM, BCS, CSCE, VEMASID)

NUCLEAR HARDENING TECHNOLOGY

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

OBJECTIVE

TRANSITION 6.2 NUCLEAR SURVIVABILITY TECHNOLOGY PRODUCTS INTO TECH DEMO PACKAGES. INTEGRATE INTO STANDARD NUCLEAR SURVIVABILITY HARDENING MODULES FOR US BY PMS, MSCS, AND ELEMENTS INVOLVED IN NEXT GENERATION/FUTURE SYSTEMS DEMOS.

rec'd 6 Dec 89

ADVANCED HARDENING TECHNOLOGY

DEMONSTRATIONS - 6.3a

- DEFENSE STANDARDIZATION AND SPECIFICATION PROGRAM (DSSP)
- NON-DEVELOPMENTAL ITEMS (NDI)
- HARDNESS ASSURANCE/HARDNESS MAINTENANCE (HA/HM)
- LARGE BLAST/THERMAL SIMULATOR (LB/TS)

PROJECTED FUNDING: $ IN MILLIONS

FY91	FY92	FY93	FY94	FY95
2 152	2.49	0.5	0.5	0.5

ADVANCED HARDENING TECHNOLOGY

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

DEMONSTRATIONS - 6.3a

- DEFENSE STANDARDIZATION AND SPECIFICATION PROGRAM (DSSP)
- NON-DEVELOPMENTAL ITEMS (NDI)
- HARDNESS ASSURANCE/HARDNESS MAINTENANCE (HA/HM)
- LARGE BLAST/THERMAL SIMULATOR (LB/TS)

NUCLEAR HARDENING TECHNOLOGY

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

WILL COVER:

- PROGRAM BACKGROUNDS
- BUDGETARY INFORMATION
- STATUS
- PLANS
- TECHNICAL BARRIERS
- INTERFACES

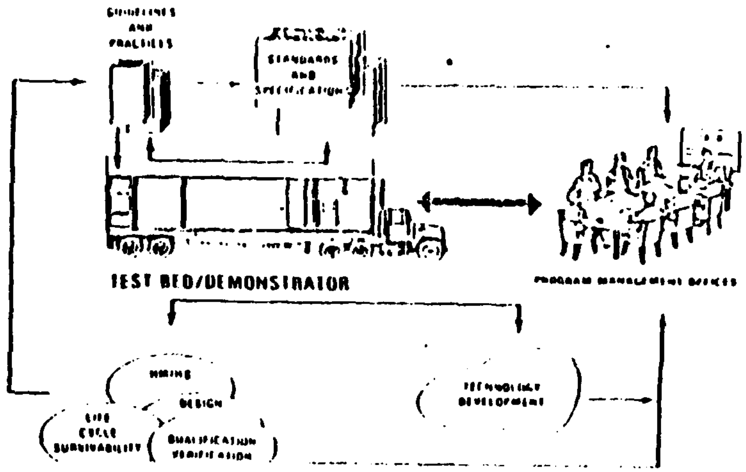
DEFENSE STANDARDS AND SPECIFICATIONS PROGRAM

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

OBJECTIVE

- **DEVELOP NEAR-TERM FIRM HARDENING GUIDELINES AND PRACTICES TO DOD-STD-2169 FOR SYSTEMS WHICH SUPPORT TIME SENSITIVE FUNCTIONS**
- **DEMONSTRATE TECHNOLOGY TO SUPPORT A LOW-RISK HARDENING PROGRAM FOR MGBC3I SYSTEMS**
- **TRANSFER TECHNOLOGY INTO DSSP FORMAT**
- **PROVIDE TECHNOLOGY TRANSFER AND APPLICATION ASSISTANCE TO USERS**



POTENTIAL CONTRACTOR SUPPORT

- Collection/Analyses of Testbed Demonstration Data
- Update of Guidelines & Procedure Documentation
- New Standards

PROGRAM MILESTONES

- TEST BED DEMONSTRATOR AND CW SYSTEM FIELDED
- ACTIVE TECHNOLOGY TRANSFER INITIATED
- DEVELOPMENT OF TRANSPORTABLE HANDBOOK AND SECTION OF MIL-STD-188-125
- UPDATE GUIDELINES AND PROCEDURES FOR DESIGN AND HARDNESS

INTRODUCTION

ARMY RESPONSIBILITIES

ATSD(AE) DESIGNATED THE ARMY TO BE RESPONSIBLE FOR STANDARDIZATION AND SPECIFICATION OF HEMP PROTECTION FOR TGBC^{3}I STRATEGIC TIME-URGENT SYSTEMS

SPECIFICALLY, THE ARMY WAS TASKED TO:

- INITIATE SELECTIVE SHORT-RUN MEASURES TO BRIDGE GAP UNTIL LONG-RANGE OBJECTIVES CAN BE MET
- COMPOSE A FRAMEWORK FOR EMP STANDARDS AND SPECIFICATIONS FROM EXISTING PROGRAMS AND SPECIFIC NEAR-TERM EMP INITIATIVES
- ADDRESS SCOPE AND TIMING OF ACTIONS LEADING TO DEVELOPMENT OF GUIDELINES AND PRACTICES AND DESIGNATE LEAD ACTIVITY THROUGH ARMY STANDARDIZATION OFFICE

ARMY PROGRAM OBJECTIVES

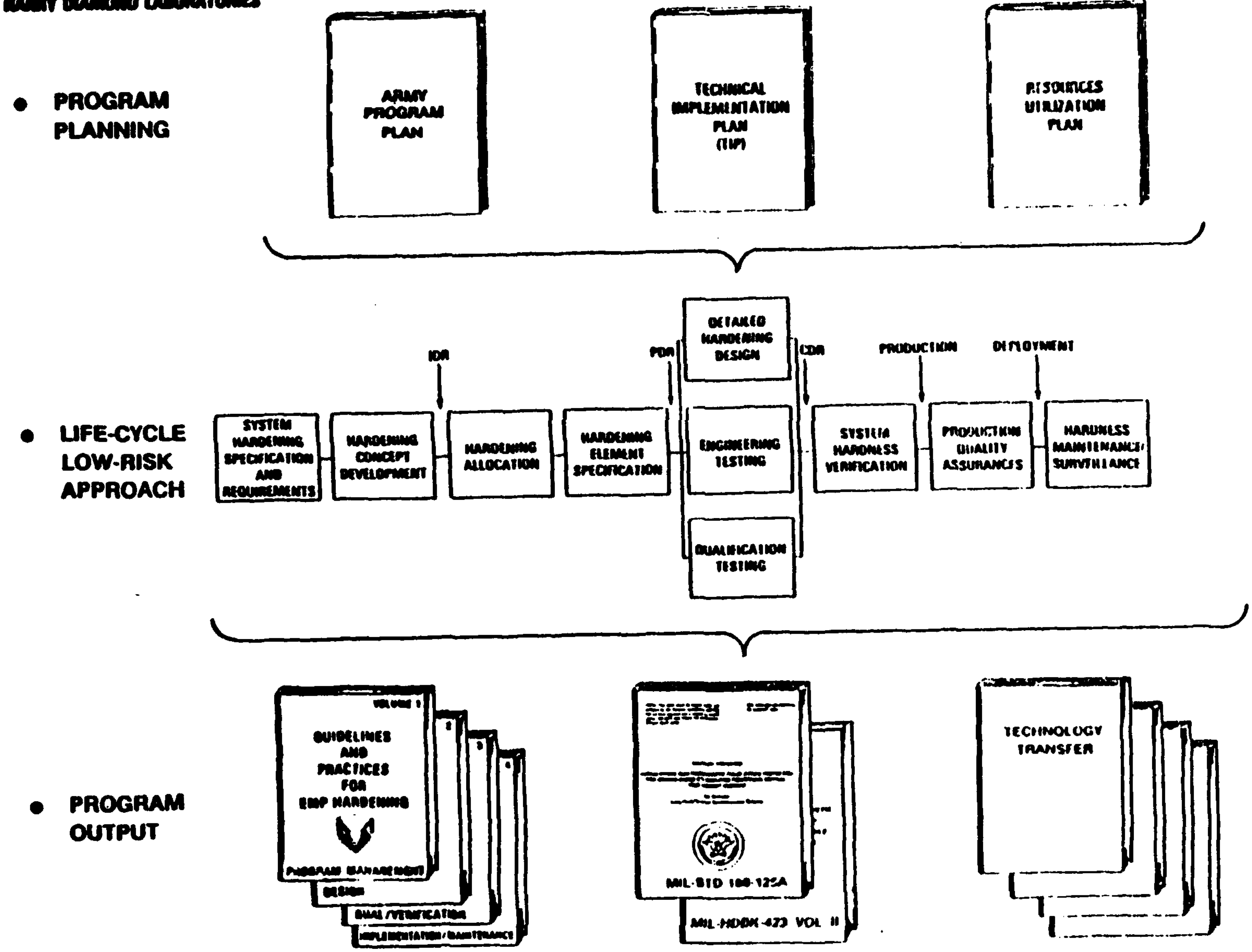
- TO DEVELOP NEAR-TERM FORMAL HARDENING GUIDELINES AND PRACTICES FOR TGBC^{3}I SYSTEMS WHICH SUPPORT TIME SENSITIVE FUNCTIONS
- TO DEVELOP (DEMONSTRATE) TECHNOLOGY TO SUPPORT A HEMP HARDENING PROGRAM FOR TGBC^{3}I SYSTEMS
- TO TRANSFER THE TECHNOLOGY INTO DEFENSE STANDARDIZATION AND SPECIFICATION PROGRAM (DSSP) FORMAT
- TO PROVIDE TECHNOLOGY TRANSFER AND APPLICATION ASSISTANCE TO USERS

PROGRAM ACCOMPLISHMENTS

TECHNICAL IMPLEMENTATION APPROACH

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

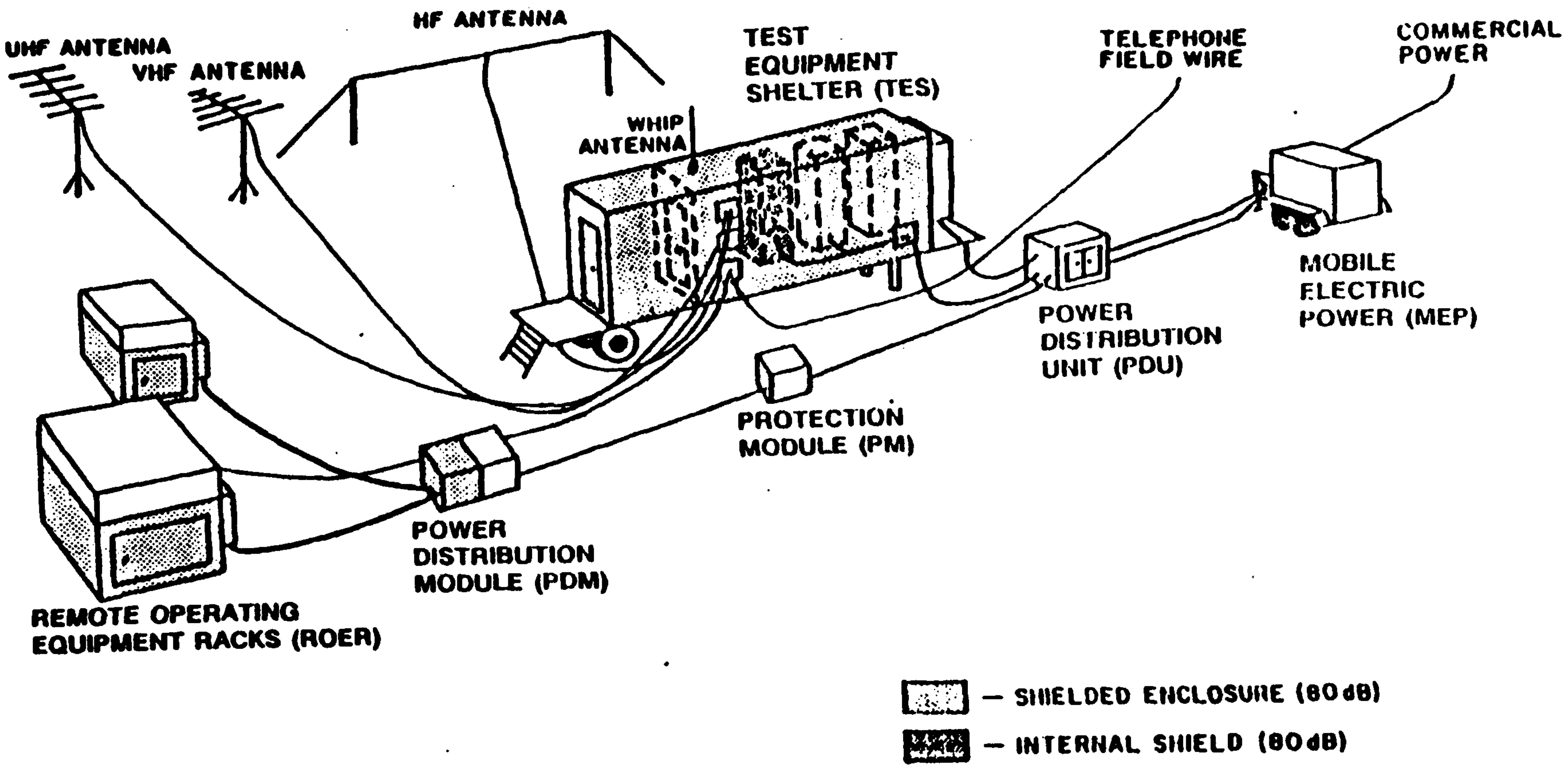


PROGRAM ACCOMPLISHMENTS

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

TEST BED/DEMONSTRATOR



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PROGRAM ACCOMPLISHMENTS

HARRY DIAMOND LABORATORIES

US ARMY LABORATORY COMMAND

TEST PROGRAM SUMMARY

TESTS PERFORMED

- HORIZONTAL POLARIZATION CALIBRATION - CW
- SIMPLE DISTRIBUTED SYSTEM
- HORIZONTAL POLARIZATION BASELINE - TB/D
- PENETRATION PROTECTION DEVICE BENCH TESTING
- SYSTEM RESPONSE - PHASE I - TB/D
- HM/HS - PHASE I

TECHNICAL ISSUES ADDRESSED

- ENVRIONMENT SPEC-E1
- NUMBER OF SHIELDS
- EXTERIOR STRESS
- STRESS ALLOCATION
- SPECIFICATION/ALLOCATION
- SPECIFICATION/LAYER SHIELD
- SURGE PROTECTION DESIGN
- HM/HS BASELINE
- VERIFICATION PROTOCOL
- BULK/INDIVIDUAL WIRE
- ESA PERFORMANCE
- EXTRAPOLATION TO THREAT
- HM/HS SIMULATORS
- HM/HS TEST METHODS
- LIFE CYCLE ANALYSIS
- STRESS BOUND ANALYSIS

RESULTS

PROGRAM ACCOMPLISHMENTS

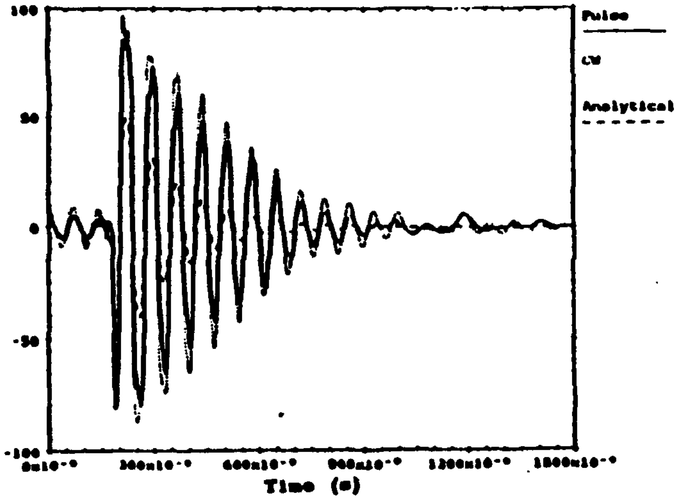
US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

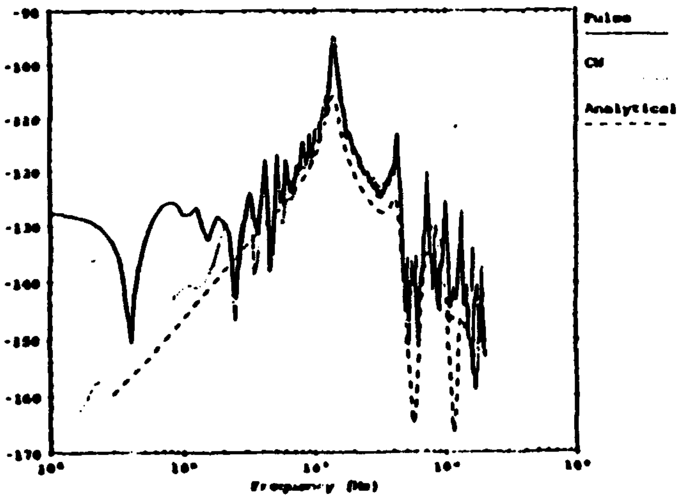
CW/PULSE COMPARISONS

10 METER DIPOLE

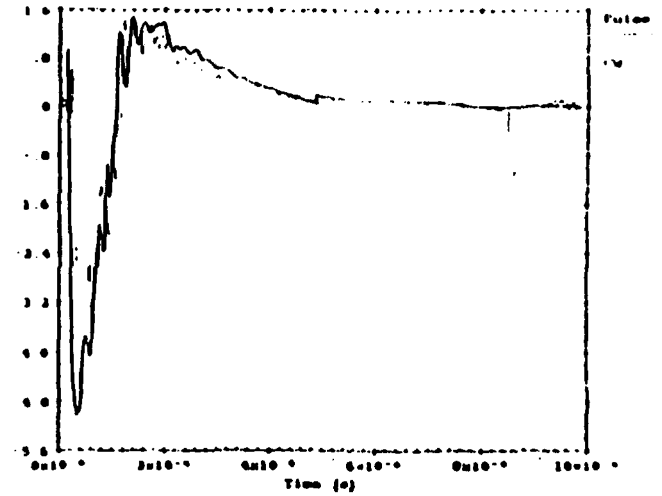
TIME

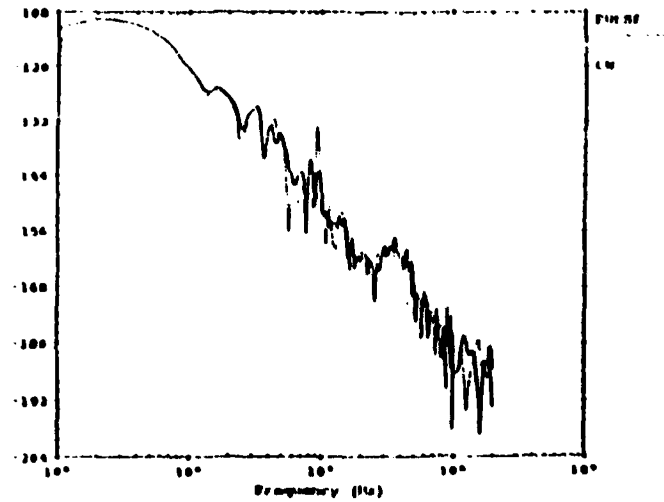


FREQUENCY



SYSTEM GROUND CABLE





PROGRAM ACCOMPLISHMENTS

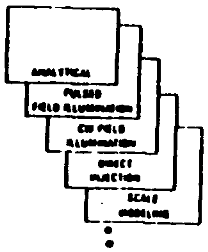
US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

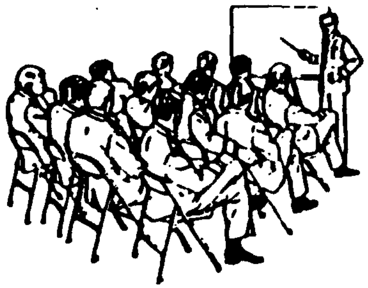
TECHNOLOGY TRANSFER

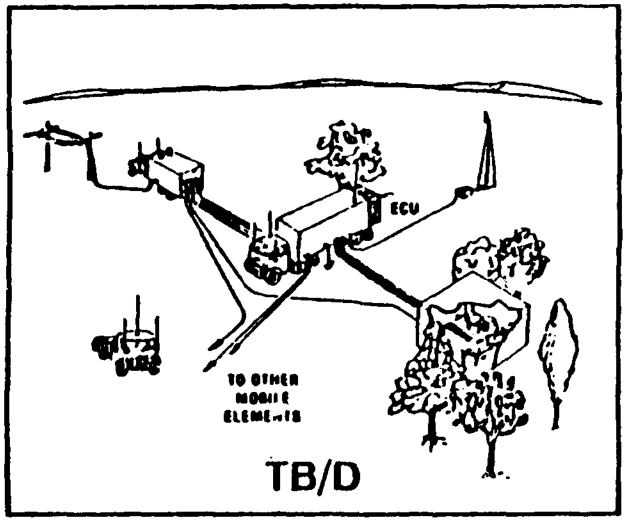
PM/SPO BRIEFINGS

DSSP REPORTS

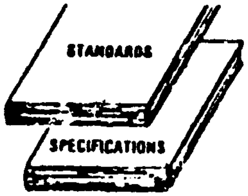


TECHNICAL PAPERS

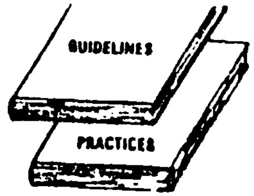




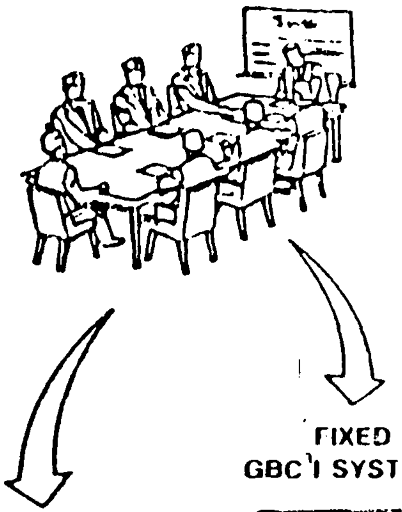
REVISED SPECS/STDS



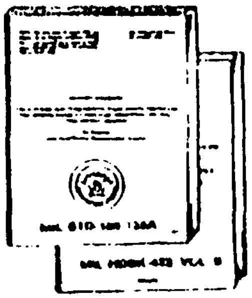
Gs & Ps DISTRIBUTED



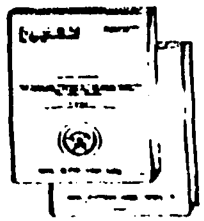
STDS/HDBK DEVELOPMENT



TRANSPORTABLE
GBC³I SYSTEMS



FIXED
GBC³I SYSTEMS



HARRY DIAMOND LABORATORIES

US ARMY
LABORATORY COMMAND

FUTURE PLANS

SCHEDULE

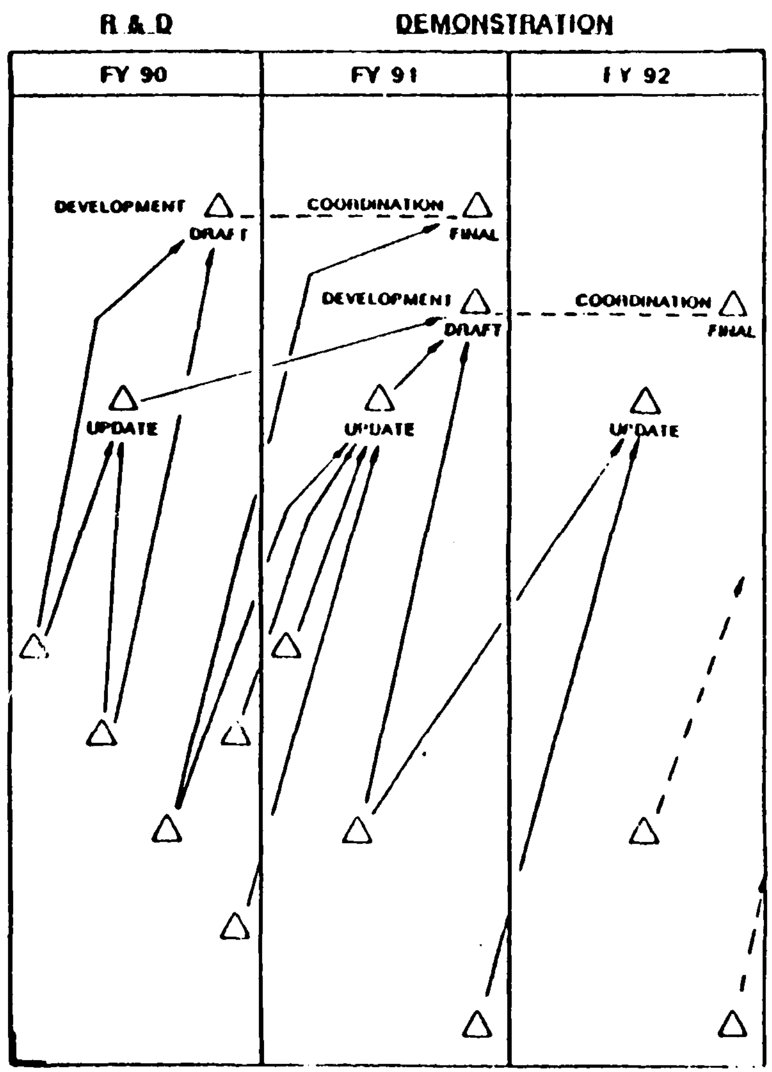
MIL-STD-188-125 (TRANSPORTABLE)

MIL-HDBK-423 (VOL II)

GUIDELINES AND PRACTICES

TESTS

- HM/HS I & II
- PPD BENCH TEST I & II
- SYSTEM RESPONSE II, III & IV
- VERTICAL CW CAL/B.L.
- HS TECHNIQUES/BITE I & II



HARDNESS ASSURANCE
HARDNESS MAINTENANCE

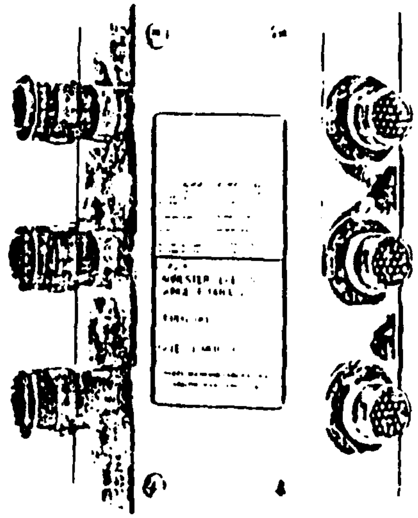
US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

OBJECTIVE

- DEVELOP TECHNOLOGY TO ENSURE LIFE CYCLE NUCLEAR SURVIVABILITY OF ARMY TACTICAL SYSTEMS
- DEVELOP RELIABILITY AND MAINTAINABILITY ANALYTICS FOR MAXIMUM HCI/HCP AVAILABILITY
- OBTAIN HCI/HCP FAILURE MODE RATE DATA BASES FROM FIELDED SYSTEMS FOR NEW SYSTEMS DEVELOPMENT
- DEVELOP GENERIC NWE TMDE FOR DEPOT AND FORWARD MAINTENANCE ECHELONS

AN/TRC 145 PIP



POTENTIAL CONTRACTOR SUPPORT

- Collection/Analyses of Failure Data
- Generic TMDE Prototype Design for Different System Types

PROGRAM MILESTONES

- DEVELOP FIELDED SYSTEMS FAILURE DATA BASE
- GENERIC TMDE PROTOTYPE
- TMDE TECHNOLOGY DEMONSTRATION

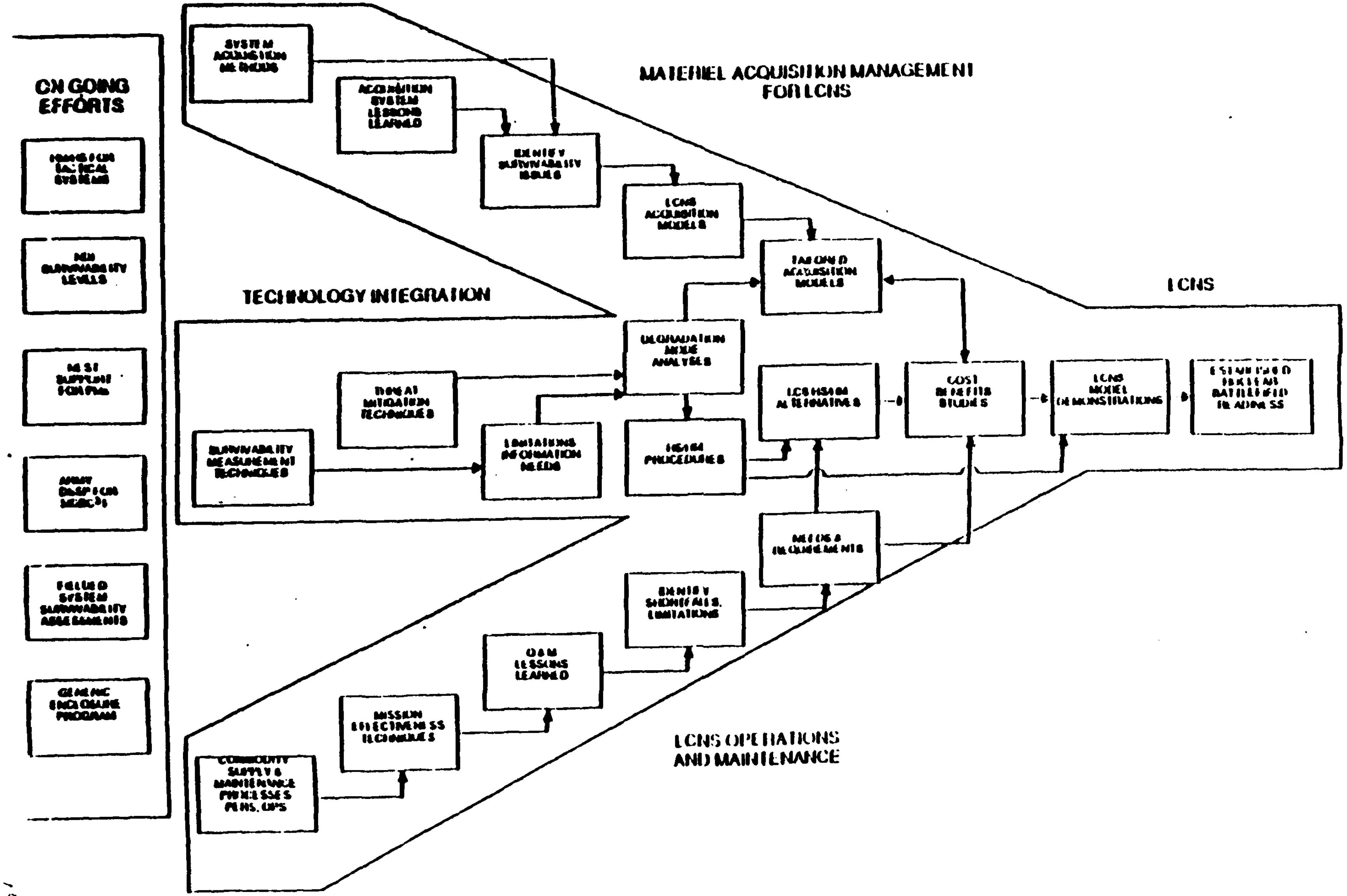
HARRY DIAMOND LABORATORIES

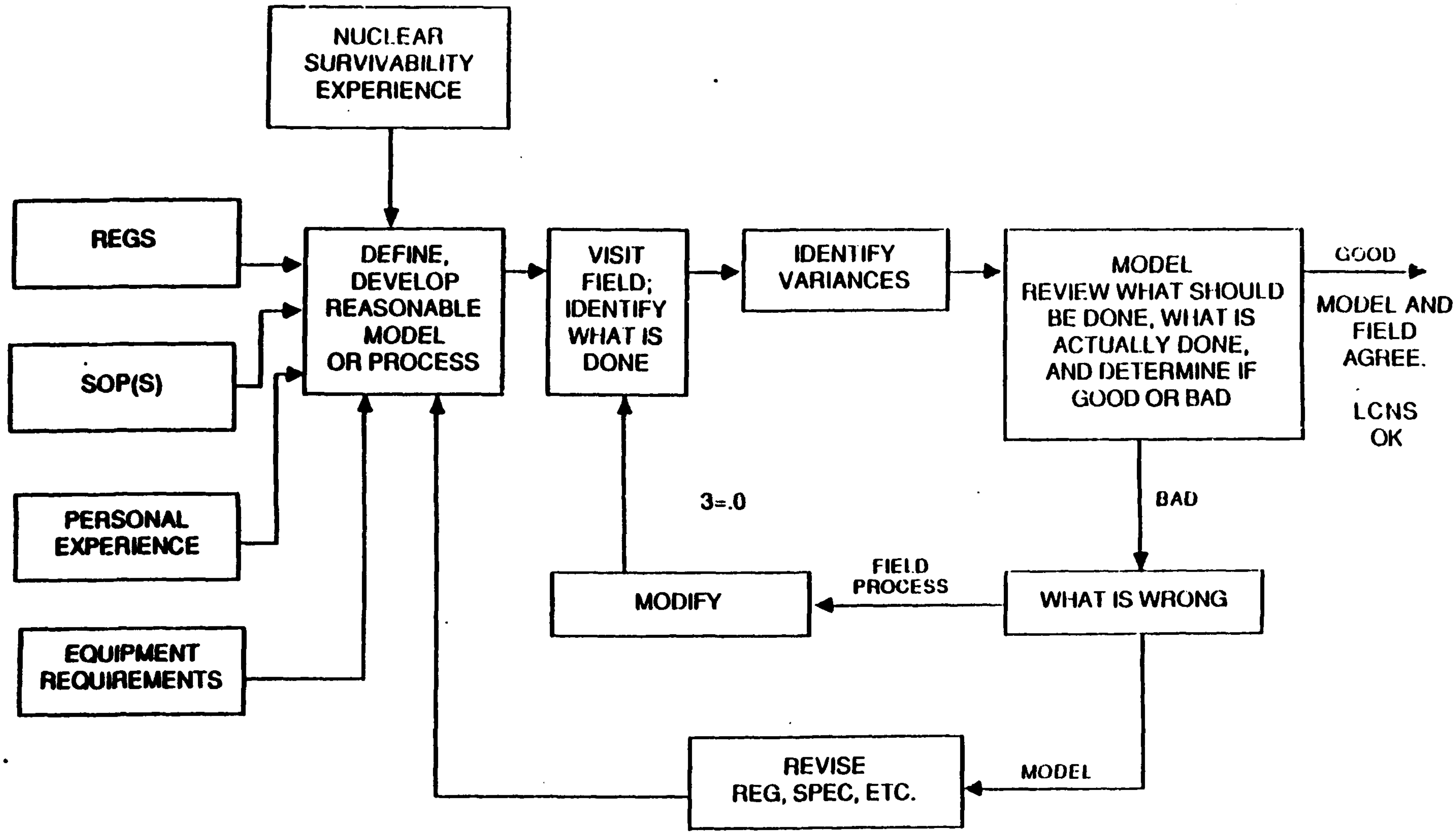
US ARMY
LABORATORY COMMAND

THRUSTS CONVERGING ON COORDINATED SOLUTION

- EXAMINE MATERIEL ACQUISITION PROCESS
- EXAMINE OPERATIONS AND SUPPORT PROCESS
- EVALUATE NS TECHNOLOGY BASE
- INTEGRATE NS THROUGHOUT LIFE-CYCLE

LCNS PROGRAM APPROACH

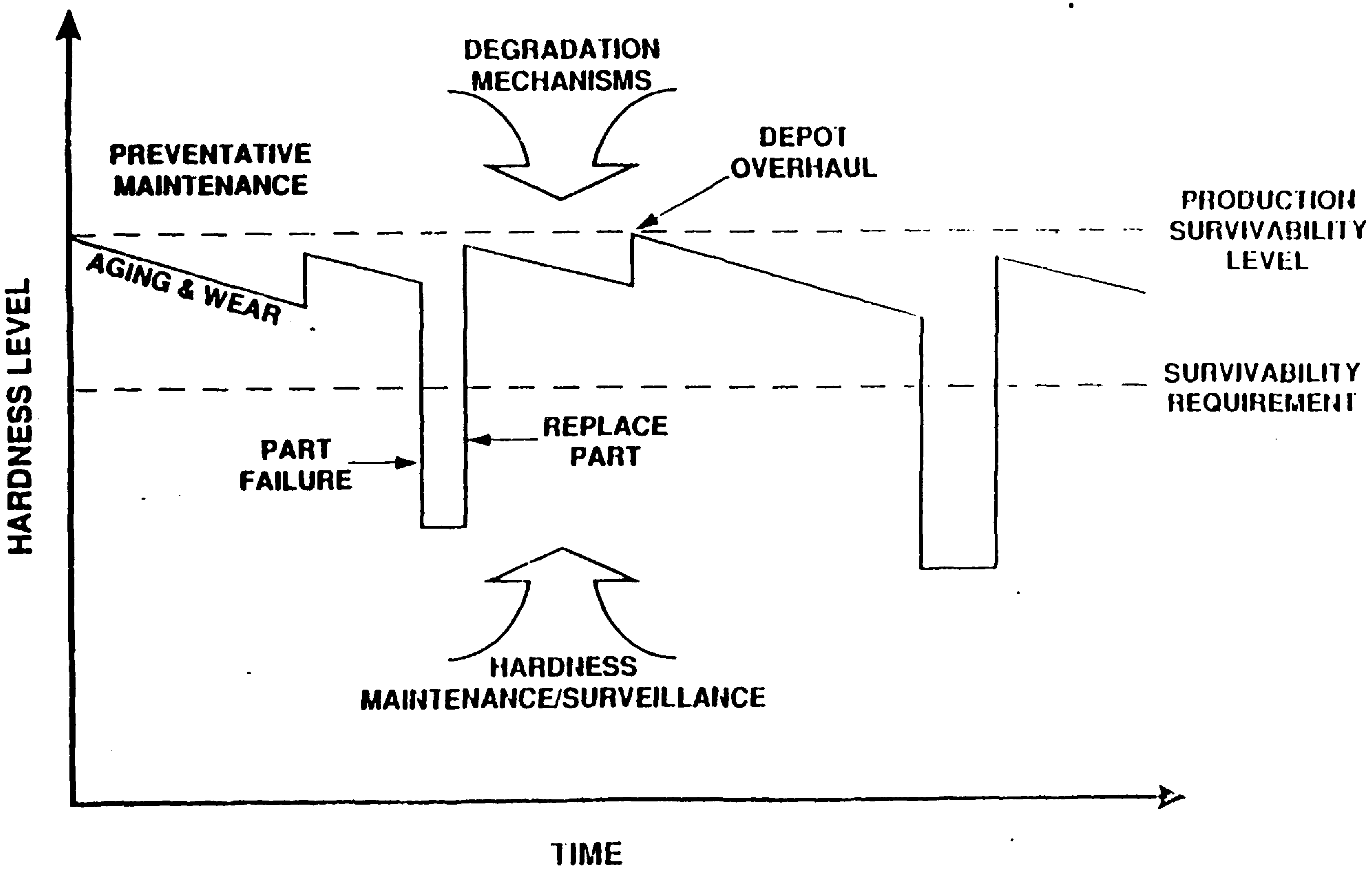



NUCLEAR SURVIVABILITY EXPERIENCE
REGS
SOP(S)
PERSONAL EXPERIENCE
EQUIPMENT REQUIREMENTS
DEFINE, DEVELOP REASONABLE MODEL OR PROCESS
VISIT FIELD; IDENTIFY WHAT IS DONE
IDENTIFY VARIANCES
MODEL
REVIEW WHAT SHOULD BE DONE, WHAT IS ACTUALLY DONE, AND DETERMINE IF GOOD OR BAD
GOOD
MODEL AND FIELD AGREE.
LCNS OK
BAD
3=.0
WHAT IS WRONG
FIELD PROCESS
MODIFY
MODEL
REVISE REG, SPEC, ETC.

HARDNESS TIME HISTORY WITH HM/HS

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES



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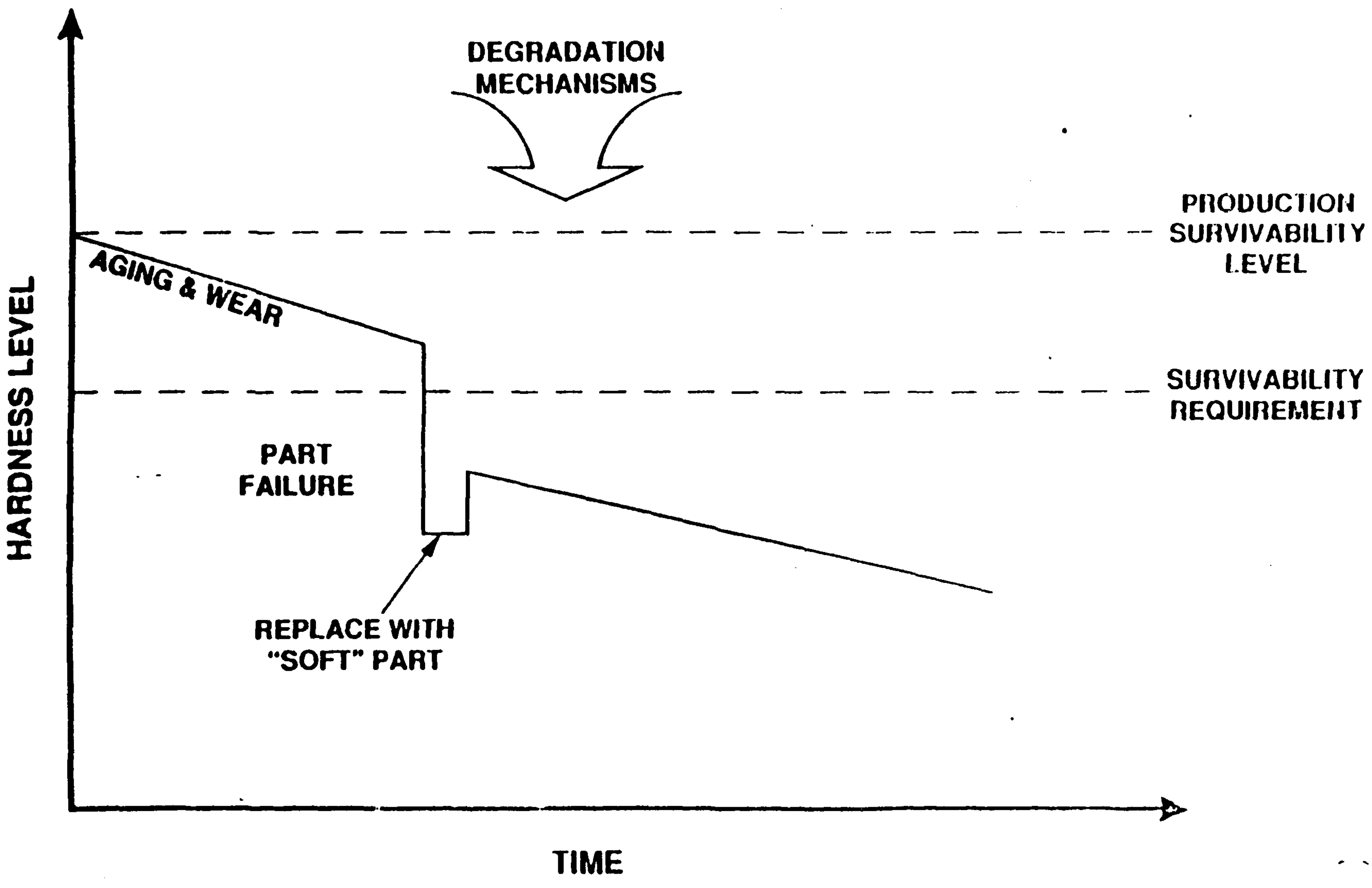
HARDNESS TIME HISTORY WITHOUT HM/HS

HARRY DIAMOND LABORATORIES

US ARMY LABORATORY COMMAND



HARRY DIAMOND LABORATORIES

US ARMY
LABORATORY COMMAND

SUMMARY

- A VIABLE LCNS PROGRAM IS ESSENTIAL IF CRITICAL SYSTEMS ARE TO PERFORM THEIR ASSIGNED MISSIONS ON THE NUCLEAR BATTLEFIELD
- THE ARMY IS SEEKING AN EFFECTIVE LCNS PROGRAM AT AN AFFORDABLE PRICE
- SUCCESS IS ENHANCED THROUGH COORDINATION AND KEY PLAYER PARTICIPATION

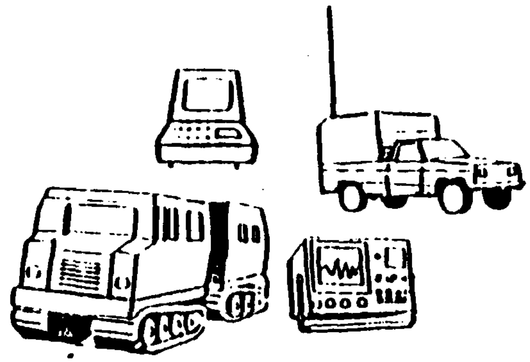
US ARMY
LABORATORY COMMAND

NON DEVELOPMENTAL ITEMS

HARRY DIAMOND LABORATORIES

OBJECTIVE

- PRODUCE GUIDELINES FOR SELECTING NUCLEAR SURVIVABLE TECHNOLOGIES IN NDI PROCUREMENT
- DEMONSTRATE NUCLEAR HARDENING TECHNIQUES THAT CAN BE COST EFFECTIVELY INCORPORATED INTO NDI



POTENTIAL CONTRACTOR SUPPORT

- Techniques for Decreasing Nuclear Vulnerability on NDI
- Identification of Emerging Technologies NDI Survivability Problems
- Updated Guidelines for NDI Procurement

PROGRAM MILESTONES

- INR SUSCEPTIBILITY OF NDI CANDIDATE TECHNOLOGIES DETERMINED
- FEASIBILITY OF ADD-ON CIRCUMVENTION TO NDI FOR INR HARDENING SHOWN
- ANALYSIS OF EMP EFFECTS ON NDI
- DEMONSTRATION OF NDI HARDENED TO INR AND EMP
- GUIDELINES FOR HARDENING NDI

NON-DEVELO. MENTAL ITEM (NDI) SURVIVABILITY

THE PROBLEM

- INCREASED USAGE OF ELECTRONICS ON TACTICAL BATTLEFIELD
- MILITARY DEVELOPMENT TIMES LAG RAPIDLY ADVANCING TECHNOLOGY
- COMMERCIAL EQUIPMENTS USE STATE-OF-THE-ART BUT ARE NOT HARDENED

NDI NUCLEAR SURVIVABILITY OBJECTIVES:

HARRY DIAMOND LABORATORIES

US ARMY LABORATORY COMMAND

- PRODUCE GUIDELINES FOR SELECTING TECHNOLOGIES IN NDI PROCUREMENTS.

- DEMONSTRATE HARDENING TECHNIQUES THAT CAN BE COST EFFECTIVELY INCORPORATED INTO NDI.

HARRY DIAMOND LABORATORIES

NDI NUCLEAR SURVIVABILITY APPROACH:

US ARMY
LABORATORY COMMAND

- DETERMINE THE NUCLEAR SUSCEPTIBILITY OF NDI CANDIDATE TECHNOLOGIES.

- INVESTIGATE AND DEMONSTRATE SURVIVABILITY ENHANCEMENT TO NDI SYSTEMS THROUGH:

    MINOR MODIFICATIONS

    ADD-ON HARDENING KITS

    USE OF PREFERRED SYSTEM TECHNOLOGIES OR CONFIGURATIONS

NDI NUCLEAR SURVIVABILITY BENEFITS:

- NUCLEAR SURVIVABLE NDI EQUIPMENT CAN RESULT IN A LARGE SAVINGS OF BOTH MONEY AND TIME OVER THAT REQUIRED FOR THE NORMAL DEVELOPMENT AND FIELDING OF ARMY EQUIPMENT.

- RESULTS ARE ALSO APPLICABLE TO UNHARDENED ARMY SYSTEMS.

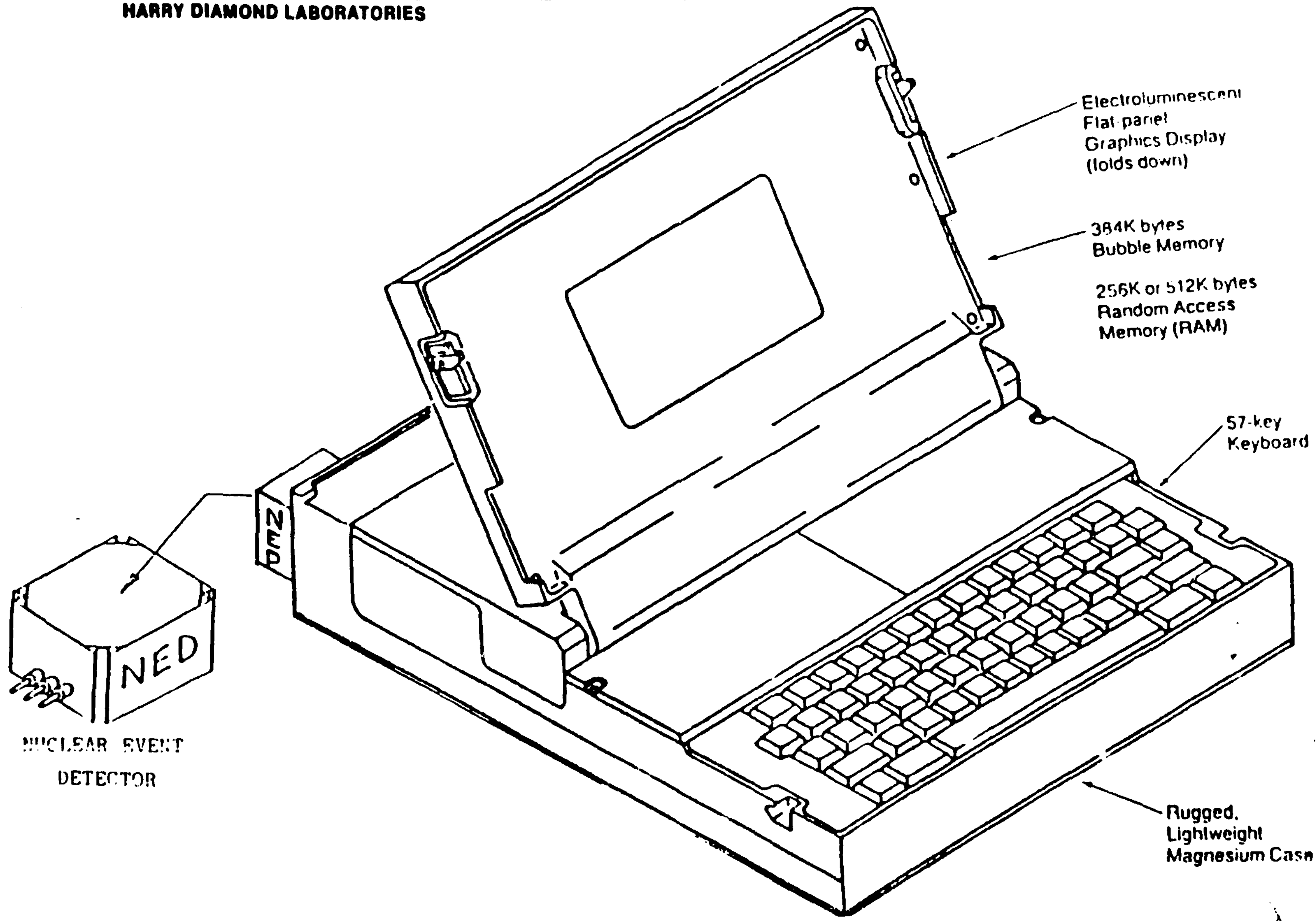
GRiD PORTABLE COMPUTER

WITH ADDED NUCLEAR EVENT

DETECTOR (NED) MODULE

US ARMY
LABORATORY COMMAND

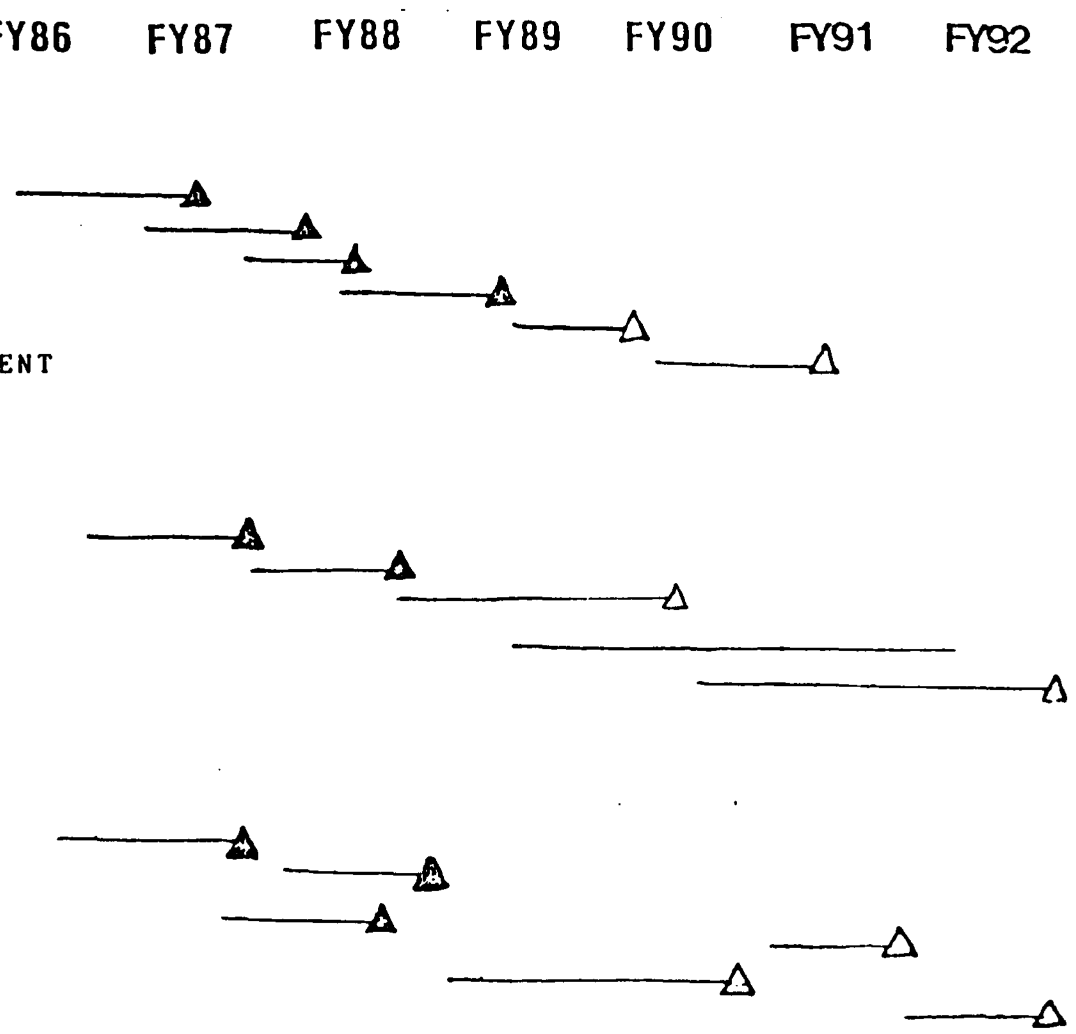
HARRY DIAMOND LABORATORIES



NDI SCHEDULE

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES



INITIAL NUCLEAR RADIATION

BASELINE SURVIVABILITY
SURVIVABILITY VALIDATION (GRID)
CIRCUMVENTION FEASIBILITY STUDY
PROVE CIRCUMVENTION CONCEPTS
SYSTEM DEMO
STATE-OF-THE-ART GUIDELINE DOCUMENT

ELECTRO-MAGNETIC PULSE

PRELIMINARY HEMP GUIDELINES
HEMP TESTS
INTERIM GUIDELINES
SREMP INPUT
FINAL GUIDELINES

THERMAL/BLAST

PROTECTIVE COATING GUIDELINES
TEST WEATHERED COATINGS
OPTICAL PROTECTION STUDY
OPTICAL PROTECTION DEMO
NDI SHOCK MITIGATION
THERMAL/BLAST GUIDELINES

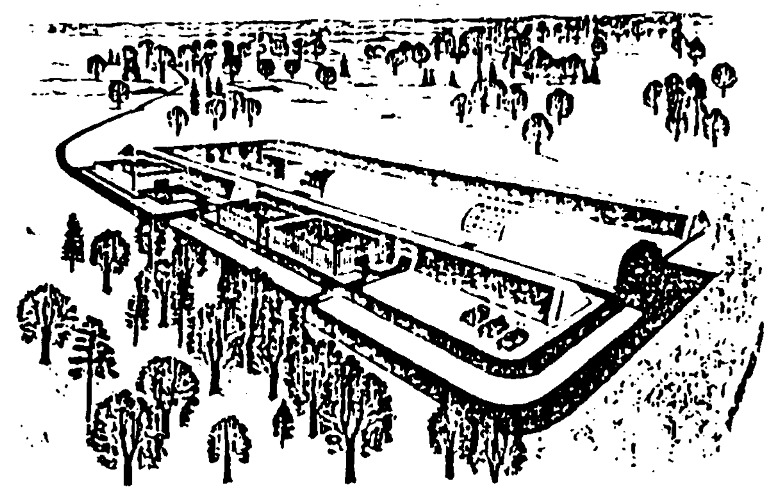
LARGE BLAST/THERMAL SIMULATOR

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

OBJECTIVE

- ACQUIRE DOD FACILITY FOR NUCLEAR BLAST/THERMAL SURVIVABILITY TESTING OF FULL SCALE EQUIPMENT TO THREAT LEVELS



LB/TS FACILITY CONCEPT

POTENTIAL CONTRACTOR SUPPORT

- Probative Tube Control System Design
- Analytical Codes for Tube/Target Response
- Instrumentation

PROGRAM MILESTONES

- CONSTRUCT TEST BED FACILITY
- 1/2 SCALE THROAT VALVE TEST
- LB/TS CONSTRUCTION
- THROAT VALVE RETROFIT
- FACILITY CHARACTERIZATION
- FULL SCALE EQUIPMENT TESTING

LARGE BLAST/THERMAL SIMULATOR

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

OBJECTIVE

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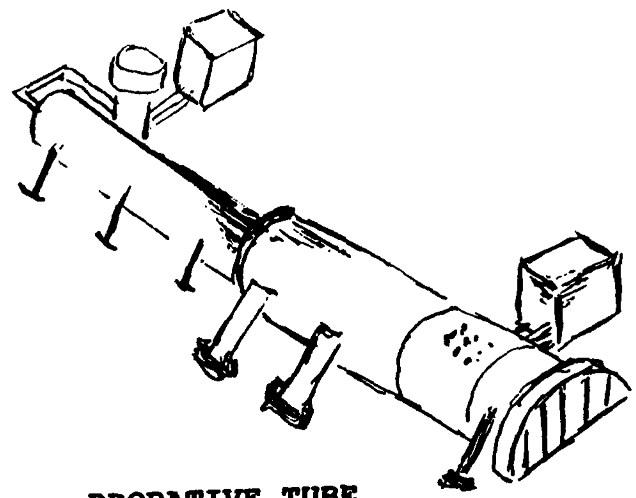


PROBATIVE TUBE

POTENTIAL CONTRACTOR SUPPORT

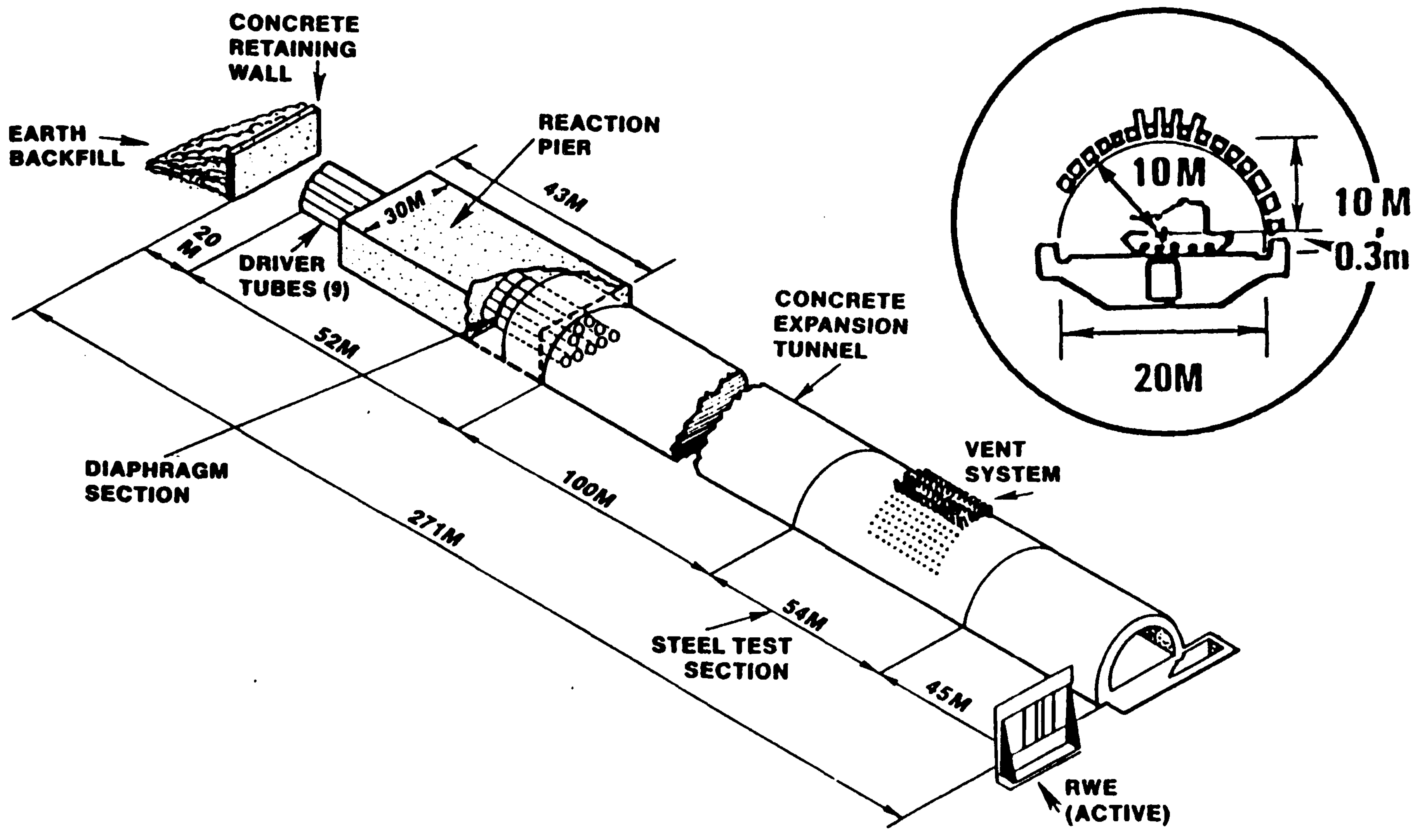
- Probative Tube Control System Design
- Analytical Codes for Tube/Target Response
- Instrumentation

PROGRAM MILESTONES

- CONSTRUCT TEST BED FACILITY
- 1/2 SCALE THROAT VALVE TEST
- LB/TS CONSTRUCTION
- THROAT VALVE RETROFIT
- FACILITY CHARACTERIZATION
- FULL SCALE EQUIPMENT TESTING

X

LARGE BLAST/THERMAL SIMULATOR



Large Blast/Thermal Simulator

Current Concepts

- Yield Range: 1 to 600 kt
- Overpressure (Maximum): 2 to 35 psi
- Coupled Thermal Source: up to 320 cal/sq cm
- Large Cross Sectional Area: 163 sq m
- Multiple Heated Nitrogen Drivers: 9
- Pebble Bed Evaporator/Superheater
- Double Diaphragm System for Gas Release
- Movable Hydralic Packers for Volume Changes
- Active Rarefaction Wave Eliminator

Blast Capabilities

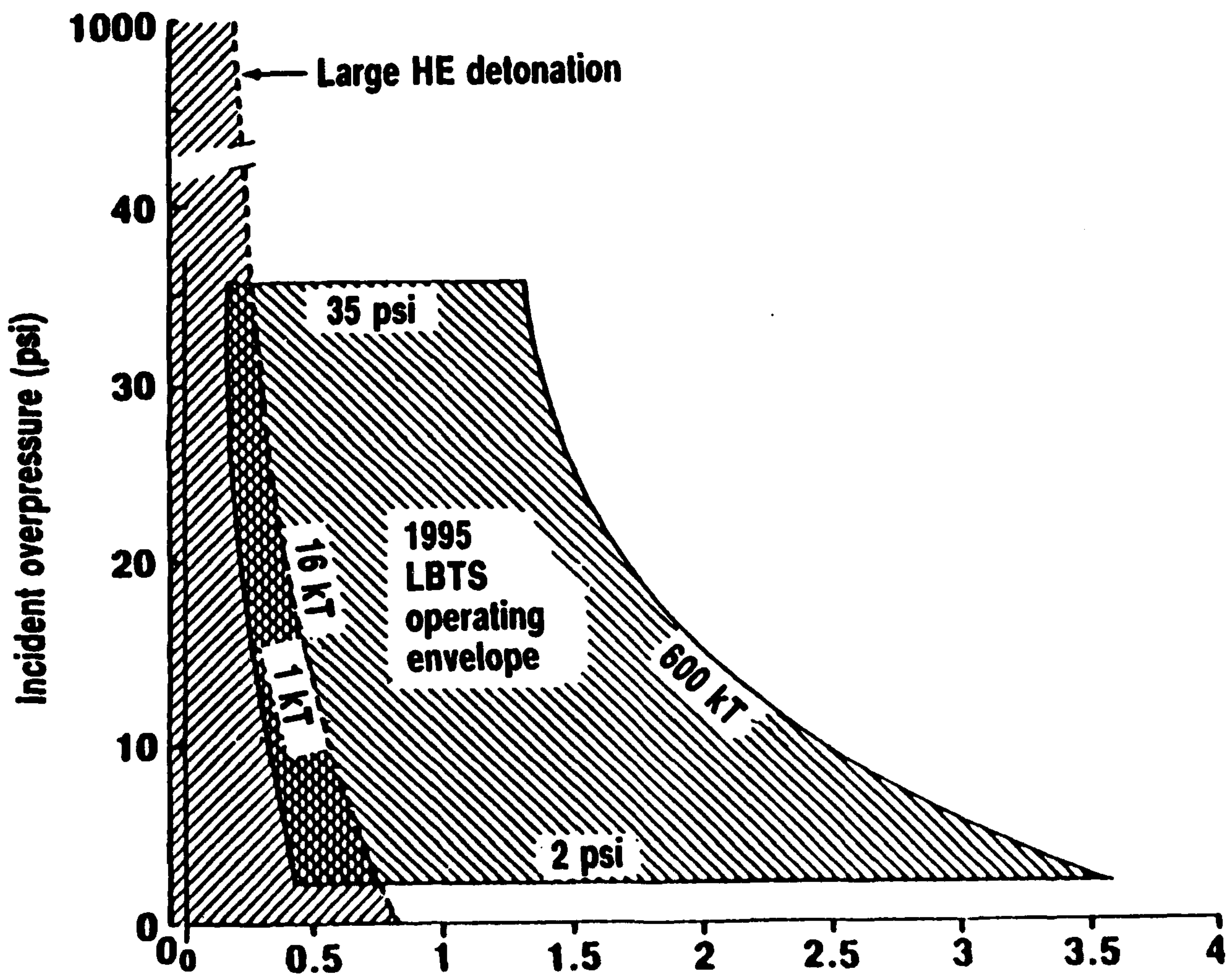
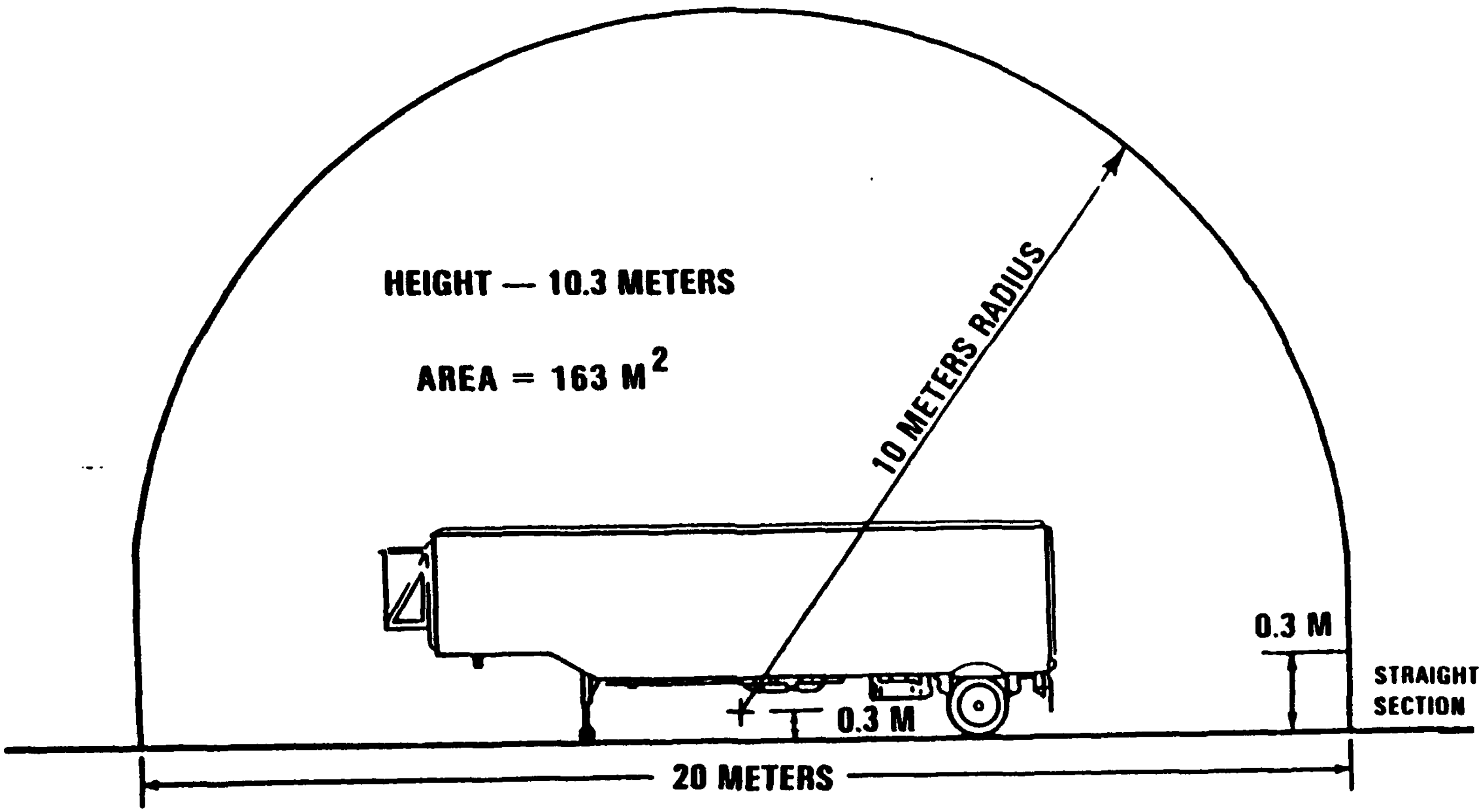


Figure 4. Blast capabilities of LB/TS and large HE detonations

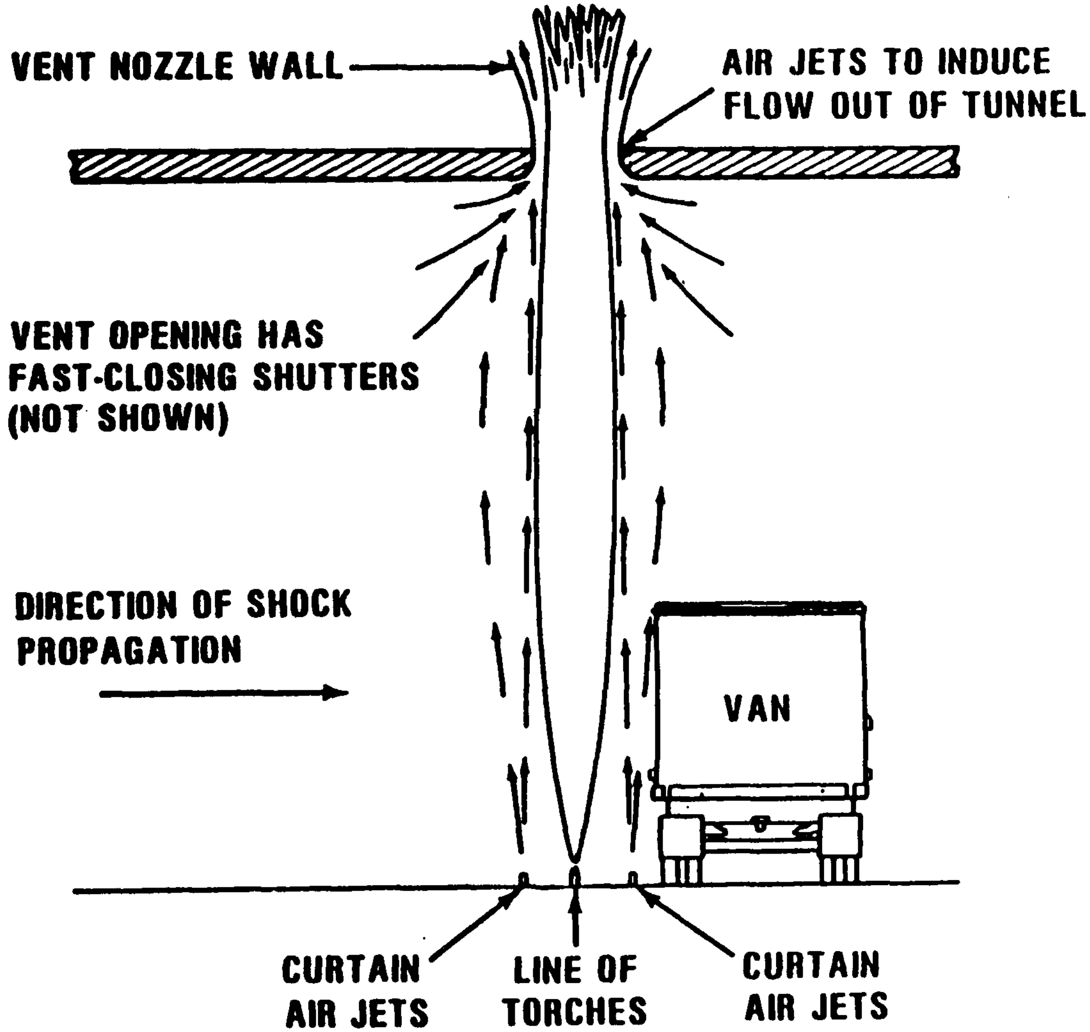
LARGE BLAST/THERMAL SIMULATOR

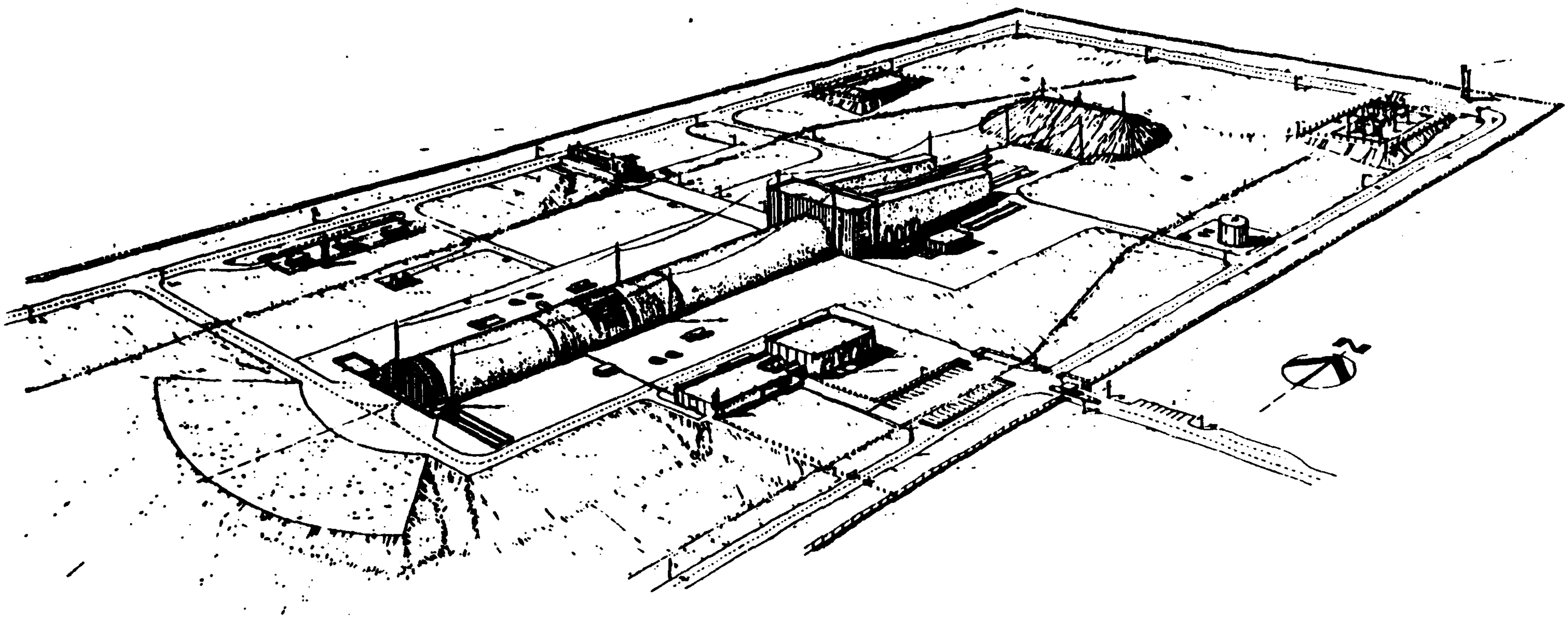
PROBABLE TEST SECTION



LARGE BLAST/THERMAL SIMULATOR

CONCEPT FOR CONTROL AND VENTING OF THERMAL SIMULATOR COMBUSTION PRODUCTS

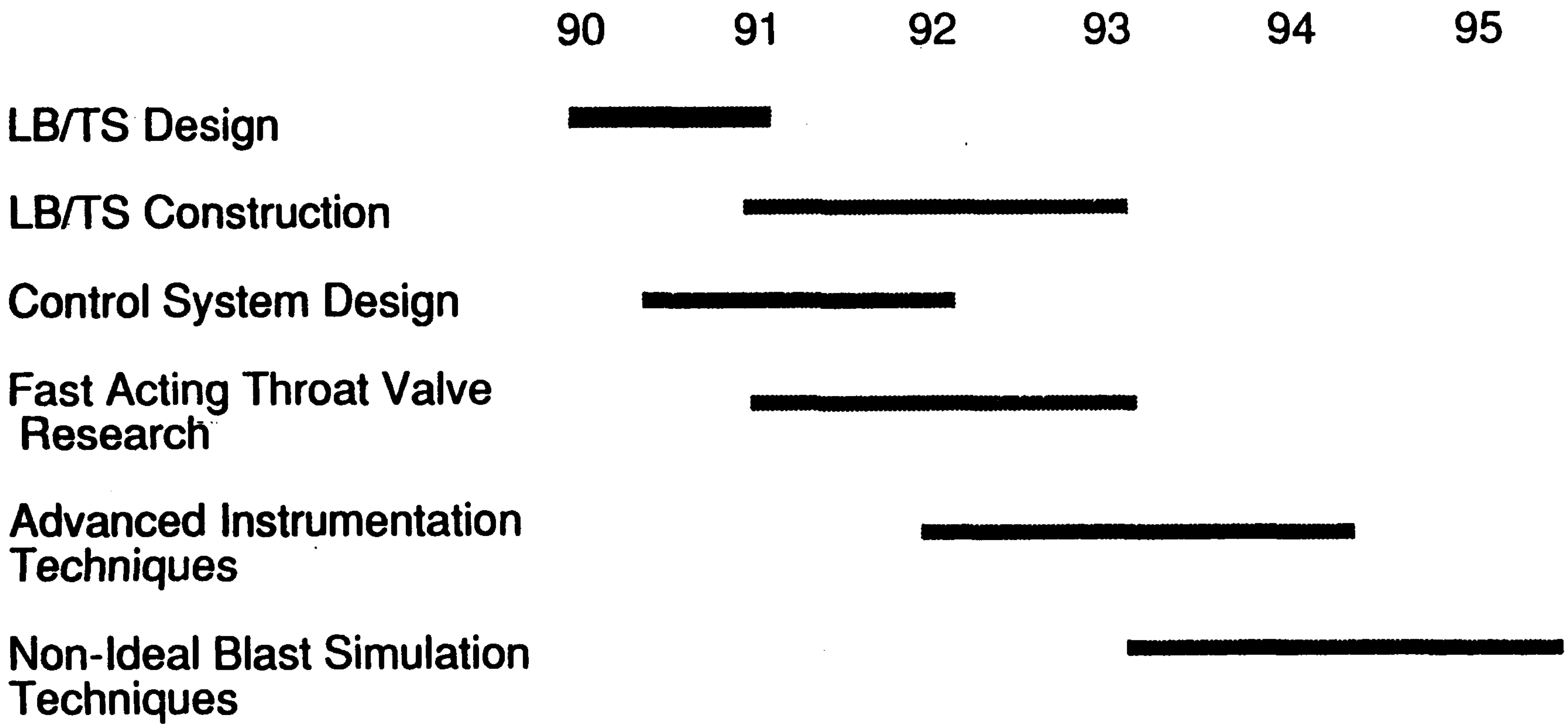




LARGE BLAST / THERMAL SIMULATOR

Large Blast/Thermal Simulator

Research and Development Schedule



U. S. ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

Aurora/Radiation Simulation Technology

Dr. Forrest J. Agee
Chief, Radiation Simulation
Technology Branch
Nuclear Survivability Laboratory

TITLE: Aurora and Proposed Tactical System Radiation (TSR) Facility

TECH BASE INVESTMENT STRATEGY AREA: S002 Modeling/Simulation

Aurora can be used to produce radiation in the form of both high-energy X rays and electron beams. Both types of radiation can be tailored to meet the needs of test objects.

DESCRIPTION:

Aurora's versatility makes it useful for a broad range of investigators. For example, Aurora produces X rays in the Gamma spectrum, allowing experimenters to assess the effects of transient radiation on electronics ranging from tiny chips to entire weapons systems. Aurora can also be used to test small objects at extremely high doses (for example, it can produce 300,000 RAD(Si) over 250 cm^3) or, it can irradiate with good dose uniformity, a volume as large as $14m^3$ at a dose of 675 RAD(Si). Currently, no test facility is capable of testing complete deployed systems at high levels of X rays or with multiple pulses (proposed TSR).

OBJECTIVE/APPROACH:

The objective is to provide the Army with the means to test completely deployed systems as large as "Peacekeeper" with multiple Gamma-ray simulators producing X rays in the 10 ME V range.

TECH BARRIERS:

The technical barriers are:

a. conceptual design for the facility: type of construction, design criteria, test area enclosure and utilities requirements, office area security systems approach and safety considerations;

b. NEPA: review of scope, technical approach, risks, etc.;

c. simulator design, drift tube design, drift tube fabrication;

d. facility detail design, drift tube testing; and

e. facility construction and simulator fabrication.

REMARKS:

In direct support of: space and strategic systems, t ti al systems, systems technology, nuclear effects simulation technology.

The Tactical System Radiation (TSR) facility repre nts a multimillion dollar investment of capital assets.

TECHNICAL POCs: Dr. Forrest J. Agee or Mr. Mark G. Caruso
Harry Diamond Laboratories
ATTN: SLCHD-NW-RS
2800 Powder Mill Road
Adelphi, MD 20783-1197

(301) 394-2290

AURORA MISSION

- PROVIDE DNA SIMULATOR OF γRAY INDUCED TREE EFFECTS TO SUPPORT <u>DOD</u> DEVELOPMENT OF
  - SPACE AND STRATEGIC SYSTEMS
  - TACTICAL SYSTEMS
  - SYSTEMS TECHNOLOGY
  - NUCLEAR EFFECTS SIMULATION TECHNOLOGY

UNIQUE FEATURES OF AURORA RADIATION FACILITY

- 45 krad GAMMA DOSE AND 3×10^{11} r/s DOSE RATE (OVER BASKETBALL SIZE VOLUME)
- BOTH INTENSE AND DIFFUSED E-BEAM CAPABILITIES
- HI-INTENSITY BREMSSTRAHLUNG CAPABILITY ($\geq$ 500 krad)
- MODERATE ENERGY BREMSSTRAHLUNG WITH BACKSCATTER
- MULTIPLE PULSE (TWO PULSES, 20 K-rad each)
- MICROWAVE RADIATION AT 1 GHz (8GW IN WAVEGUIDE SO FAR)
- COMBINED ELECTRON AND GAMMA (SREMP)
- FAST RISE, SHORT PULSE SGEMP

TACTICAL SYSTEMS RADIATION (TSR) FACILITY

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

- PROVIDE THE ARMY THE CAPABILITY TO TEST THE HARDNESS AND VULNERABILITY OF ARMY TACTICAL SYSTEMS TO THE TACTICAL NUCLEAR BATTLEFIELD ENVIRONMENT
- PROVIDE THE ARMY THE CAPABILITY FOR RESEARCH AND TESTING TO INSURE THE HARDNESS OF DEVELOPMENTAL FUTURE ARMY C^3 SYSTEMS

AURORA TESTING SUPPORTS TRI-SERVICE PROGRAM

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

1984-1988

- PEACEKEEPER MISSILE (12 TESTS)
- ARMY TACTICAL CONVERTER
- ARMY SINGARS (4 TESTS)
- OSD-PIF AURORA MODERNIZATION
- SANDIA NATIONAL LABS CAPACITORS
- ARMY TACTICAL SREMP (4 TESTS)
- DNA-SNL SIMULATION FIDELITY
- AFWL SOIL CONDITIONS
- ARMY AN/UGT-74
- SDIO OPTICAL WINDOWS (3 TESTS)
- ARMY TACTICAL SGEMP (2 TESTS)
- DNA UGT GAGE
- NAVY UGT
- ARMY GRID COMPUTER (2 TESTS)
- SDIO HPM (3 TESTS)
- ARMY INDENTED DIODE
- DSCS III
- ARMY TACTICAL 3KW GENERATOR
- ARMY LOW JITTER SWITCH
- DNA MISTY ECHO UGT (2 TESTS)
- ARMY M-109 HOWITZER SGEMP
- NAVY CID STAR TRACKER
- ARMY/SNL XM785 FUZE/W82 PROJECTILE (4 TESTS)
- ARMY SBIR SOFTENED X-RAYS (4 TESTS)
- ARMY A TO D CONVERTERS
- ARMY PHOTOCONDUCTIVE DIAMOND TEST
- ARMY TACTICAL POWER SUPPLIES (2 TESTS)
- ARMY XM42 FUZE SETTER (3 TESTS)
- ARMY XM749 FUZE
- NSA KOK-13 RUTTER COMSEC (3 TESTS)

TECHNOLOGY TO WIN

AURORA TESTING SUPPORTS TRI-SERVICE PROGRAM

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

1989

- ARMY TACTICAL SREMP
- ARMY TACTICAL QUIET MOTOR GENERATOR
- ARMY LOW JITTER SWITCH (2 TESTS)
- PEACEKEEPER MISSILE (2 TESTS)
- ARMY TACTICAL GENERIC ENCLOSURES
- SDIO HIGH POWER MICROWAVES
- NSA RUTTER
- TRIDENT II
- MARX GENERATOR INSTALLATION AND TESTING

1990-1994

- PEACEKEEPER MISSILE (15 TESTS)
- ARMY FUZE UPGRADE
- ARMY DISTANT LIGHT UGT (6 TESTS)
- ARMY TACTICAL SOURCE REGION PROGRAM
- ARMY TSR SIMULATOR PROGRAM
- NSA COMSEC
- NAVY UHF FOLLOW-ON (2 TESTS)
- SDIO HIGH POWER MICROWAVES
- SMALL ICBM
- NUMEROUS OTHER ARMY, NAVY, USAF, DOD AGENCY AND DOE PROGRAMS YET TO BE SCHEDULED

AURORA USERS—THE EXPERIMENTERS

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

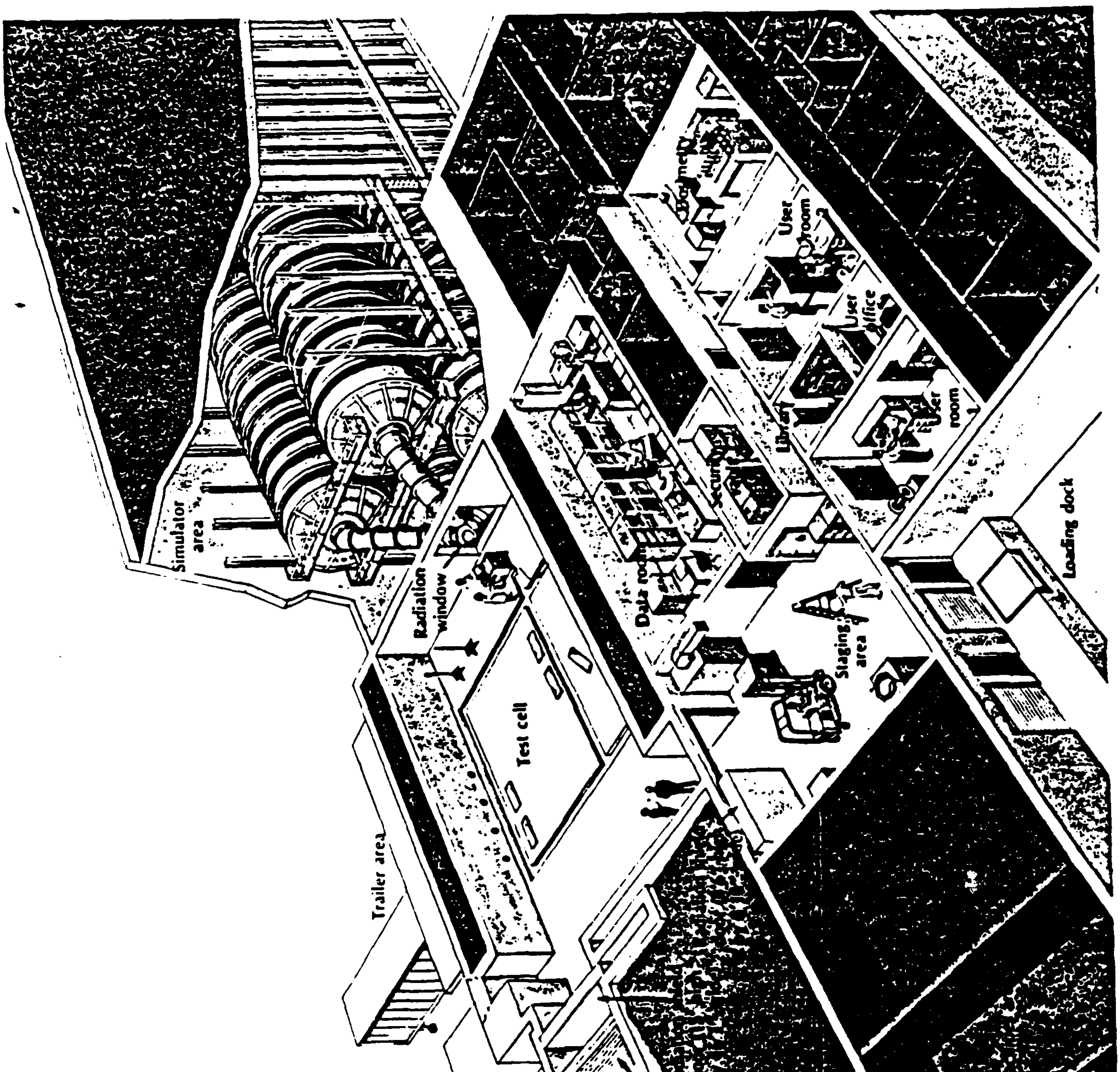
GOVERNMENT

HARRY DIAMOND LABORATORIES
NAVAL RESEARCH LABORATORIES
NAVAL SURFACE WEAPONS CENTER
US ARMY MICOM
DOE NATIONAL LABORATORIES
SANDIA
LOS ALAMOS
LAWRENCE LIVERMORE

INDUSTRY

MCDONNELL DOUGLAS
SPERRY
UNISYS
MARTIN MARIETTA
BELL TELEPHONE LABORATORIES
HONEYWELL INT.
HUGHES AIRCRAFT
SRI
BALL AEROSPACE

BERKELEY RESEARCH ASSOCIATES
SIMULATION PHYSICS INC.
GENERAL ELECTRIC
RCA
NORTHROP
APPLIED PHYSICS LABORATORY – JOHNS HOPKINS
AEROJET ELECTRO SYSTEMS
BENDIX
LOCKHEED MISSILES & SPACE CO.
RAYTHEON
MISSION RESEARCH CO.
AVCO
SAIC
JAYCOR
ITT
ROCKWELL
PHYSICS INTERNATIONAL
PULSE SCIENCES INC.
DESIGN ANALYSIS CONSULTANTS

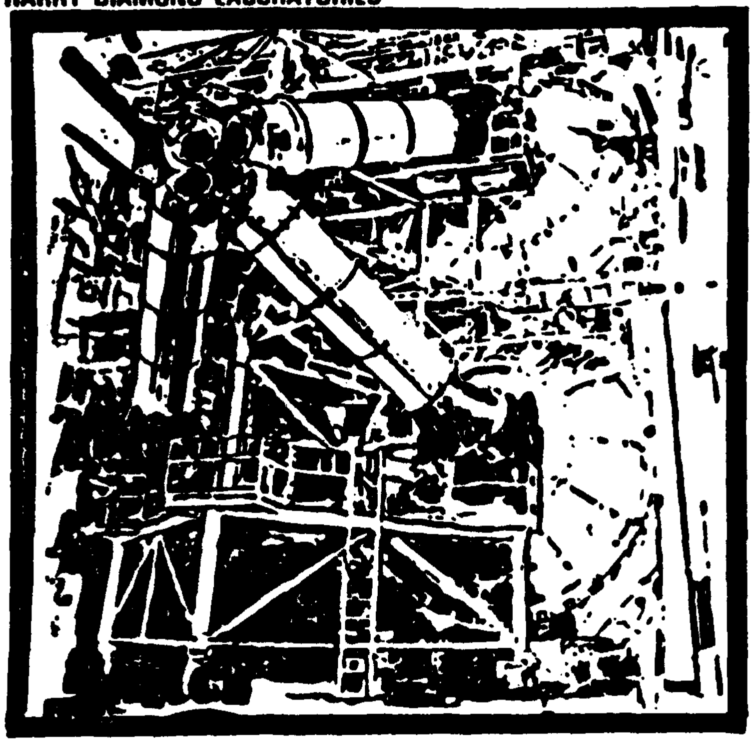


Simulator area
Radiation window
Test cell
Trailer area
Staging area
Loading dock
Rollup door
User room
User office

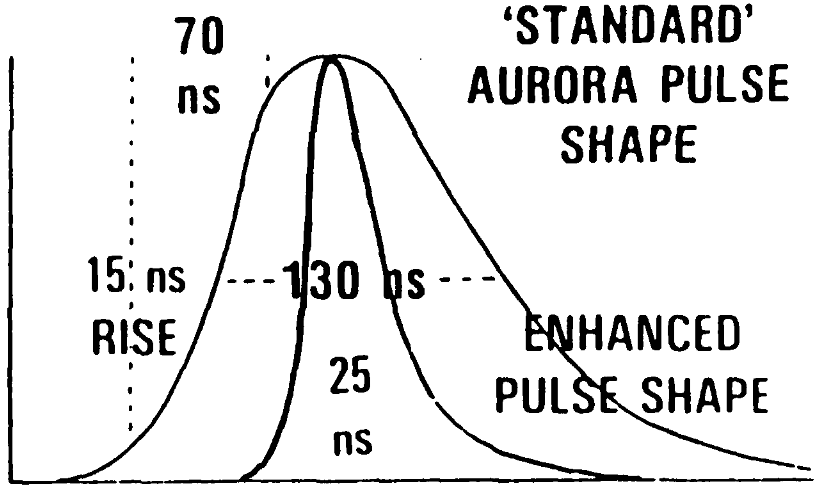
AURORA PULSE SHAPE
ENHANCEMENT UPGRADES

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

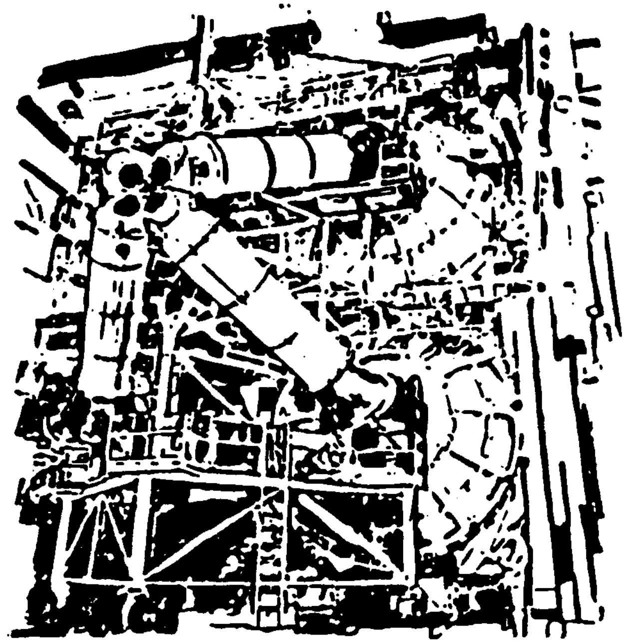


Aurora

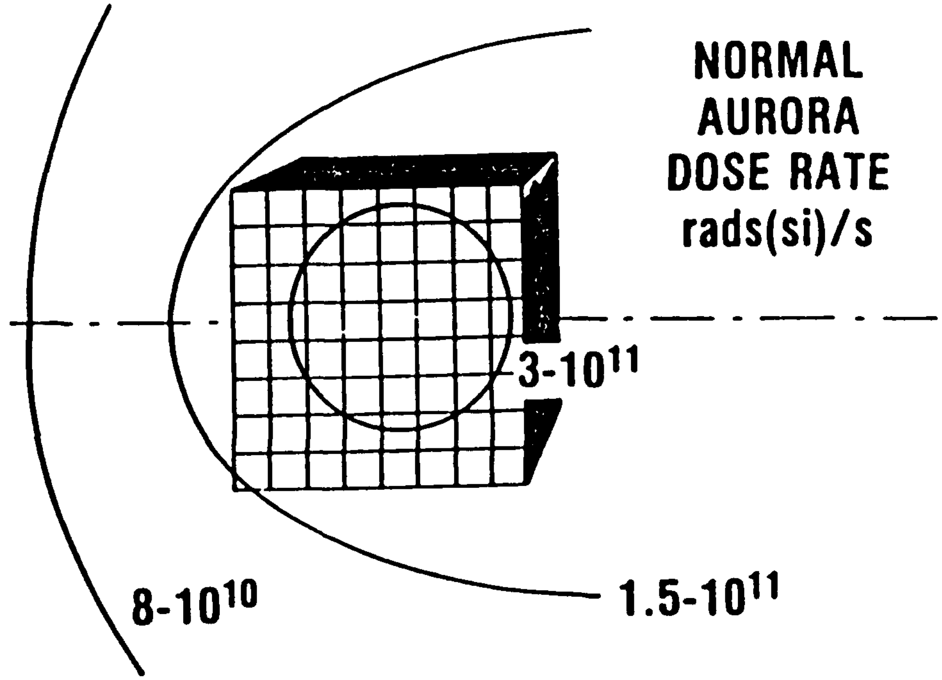


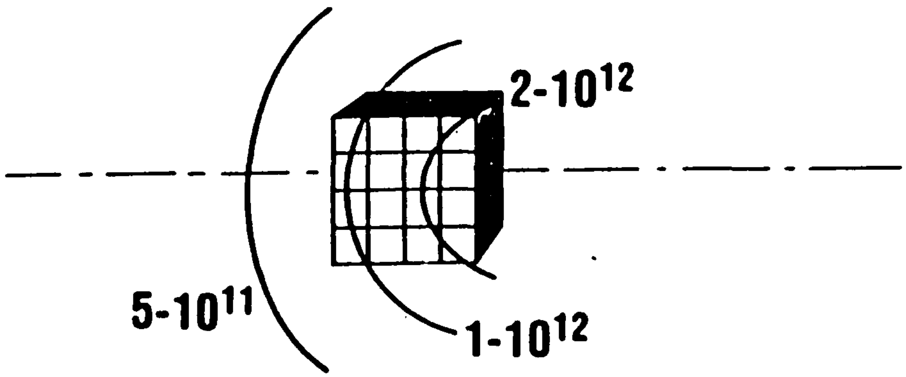
- ELECTRON BEAM DRIFT TUBE SHARPENS RISE TIME
- DIVERTER SWITCHES SHORTEN PULSE WIDTH

AURORA HIGH–INTENSITY BREMSSTRAHLUNG UPGRADE



Aurora





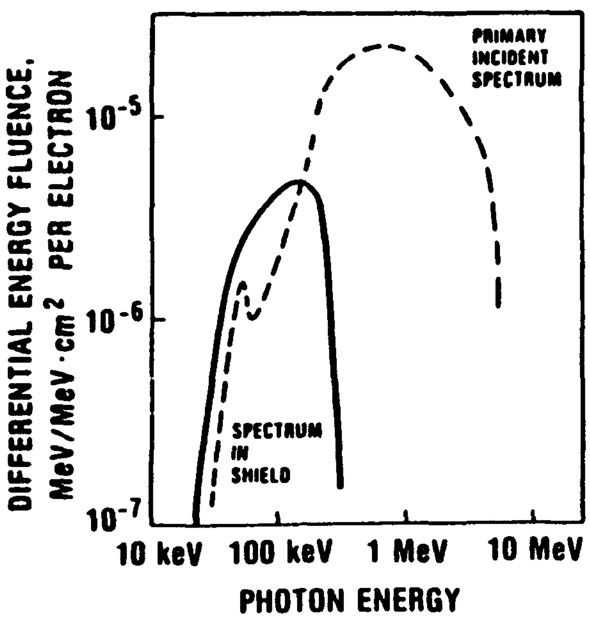
HIGH—INTENSITY
BREMSSTRAHLUNG
ENVIRONMENT

SOFTENED X-RAY CAPABILITY AT AURORA

US ARMY
LABORATORY COMMAND

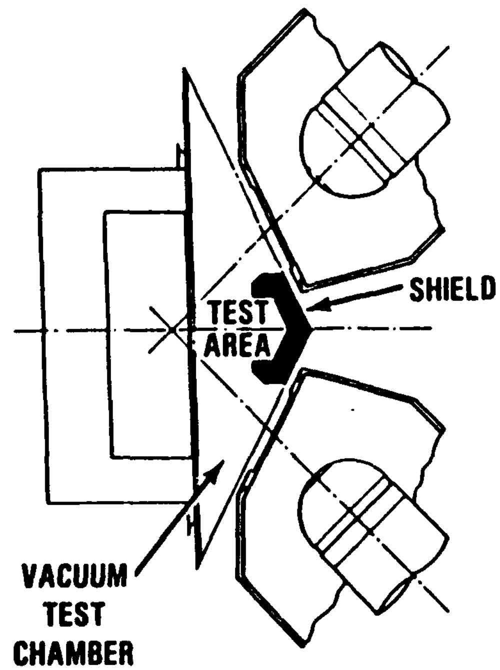
HARRY DIAMOND LABS

SPECTRUM COMPARABLE TO 1.5 MeV BREMSSTRAHLUNG



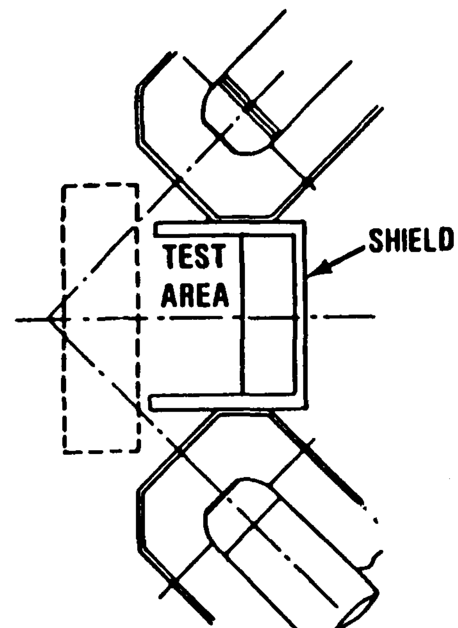
PRESENT CAPABILITY

- 1600 EM² TEST AREA
- 2.6 KRADS (Si) WITH 2:1 UNIFORMITY

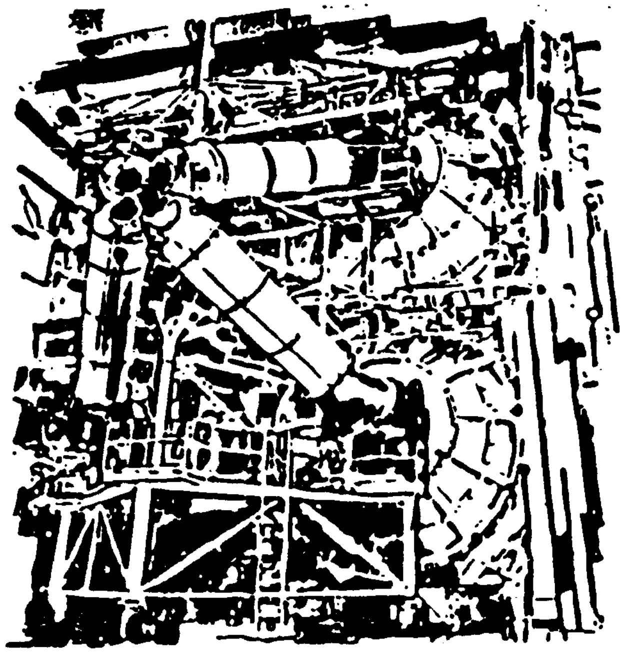


"LARGE ANODE TIP MODIFICATIONS"

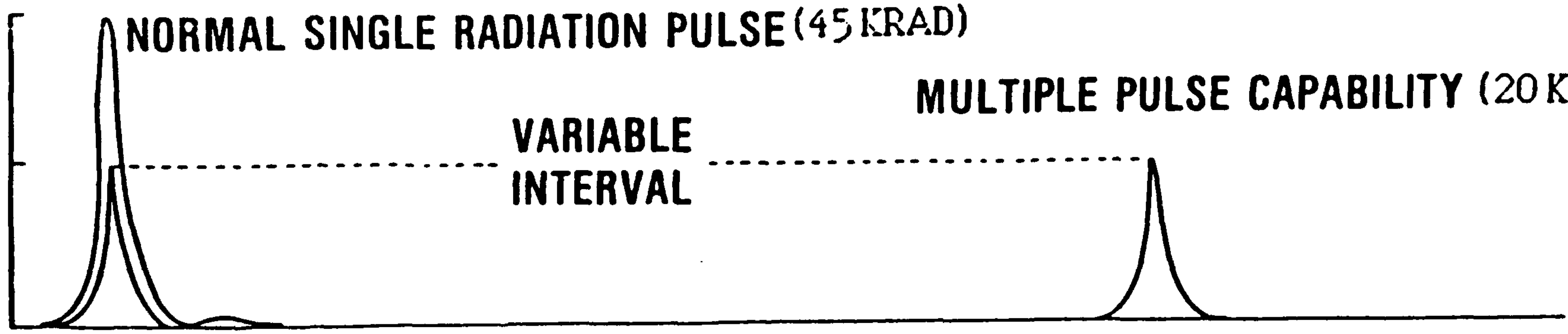
- NEW ANODE TIPS TO GIVE 10,000 CM² TEST AREA
- 2 KRADS (Si) WITH 2:1 UNIFORMITY



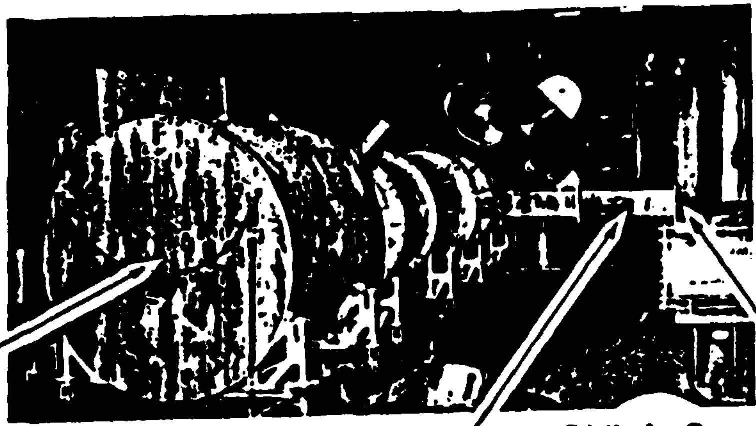
AURORA PULSE SHAPE ENHANCEMENT UPGRADES



Aurora



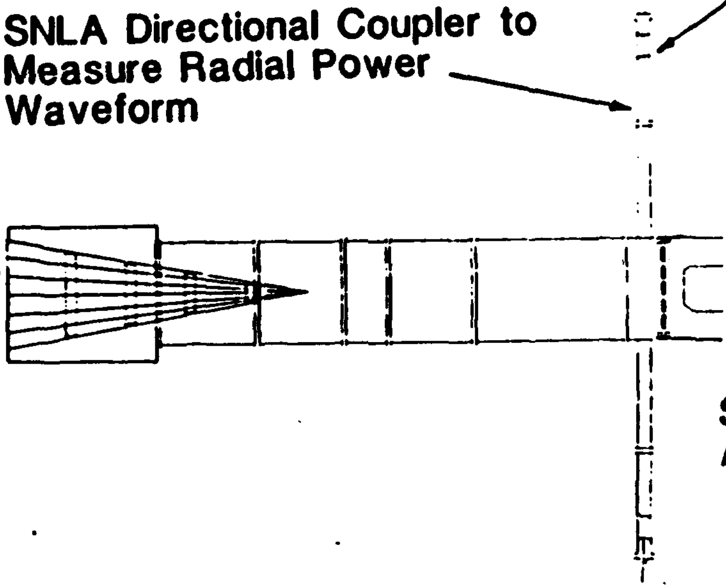
AURORA Reflex Diode Microwave Generation Experiment



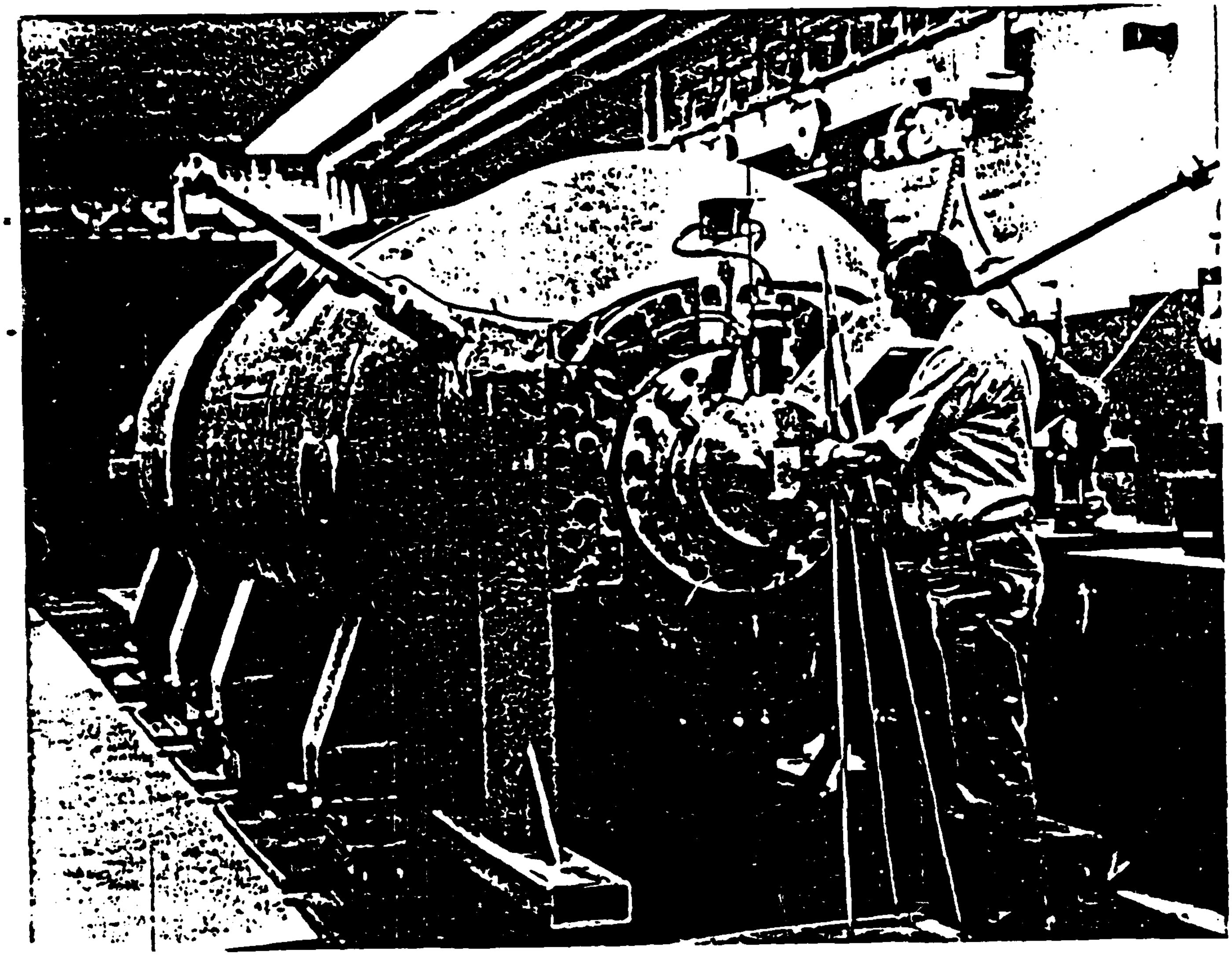
LANL Wire Calorimeter to Measure Axial Microwave Energy

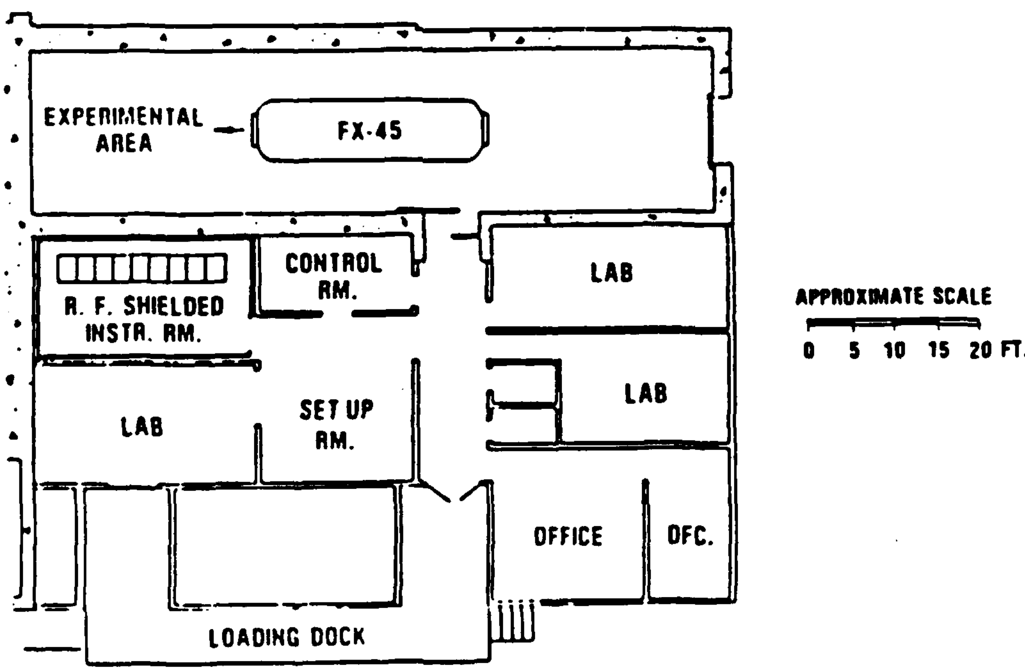
SNLA Space Cloth Calorimeter to Measure Radial Microwave Energy

SNLA Directional Coupler to Measure Radial Power Waveform



Cross-Sectic 'iew of Reflex Diode and Diagnostics





HIFX FACILITY FLOOR PLAN

TECHNOLOGY TO WIN

U. S. ARMY
LABORATORY COMMAND

Domestic Technology Transfer Opportunities

Clifford E. Lanham
Army Domestic Technology
Transfer Program Manager

US ARMY
LABORATORY COMMAND

ARMY

DOMESTIC
TECHNOLOGY TRANSFER
PROGRAM

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PROGRAM GOALS

US ARMY
LABORATORY COMMAND

THE DOMESTIC TECHNOLOGY TRANSFER PROGRAM IS INTENDED TO MAXIMIZE THE BENEFIT FROM THE INVESTMENT IN ARMY R&D BY:

- ACHIEVING MORE RAPID TECHNOLOGY SPINOFF FOR IMPROVED PRODUCTS AND PROCESSES IN DOMESTIC INDUSTRY
- PROVIDING TECHNICAL ASSISTANCE IN REGIONAL, STATE, AND LOCAL ECONOMIC DEVELOPMENT
- PROVIDING TECHNICAL ASSISTANCE TO STATE AND LOCAL GOVERNMENTS FOR IMPROVED PRODUCTIVITY (>$100 BILLION SECTOR OF ECONOMY)

NATIONAL POLICY

US ARMY
LABORATORY COMMAND

IMPROVING TECHNOLOGY TRANSFER FROM FEDERAL LABORATORIES IS CONSIDERED IMPORTANT IN ADDRESSING THE "COMPETITIVENESS ISSUE". AS A RESULT:

- THERE WAS STRONG BI-PARTISAN SUPPORT FOR THE NEW LEGISLATION AND ITS AGGRESSIVE IMPLEMENTATION.
- RAPID IMPLEMENTATION WAS REQUIRED BY EXECUTIVE ORDER 12591 (10 APRIL 1987).
- THERE HAVE BEEN NUMEROUS CONGRESSIONAL HEARINGS AND A GAO FOLLOW-UP.

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THE STEVENSON - WYDLER TECHNOLOGY INNOVATION ACT OF 1980

US ARMY
LABORATORY COMMAND

PRINCIPAL PROVISIONS OF SEC. 11

- STATED THAT THE FEDERAL GOVERNMENT WILL STRIVE TO TRANSFER ITS TECHNOLOGY
- REQUIRED EACH FEDERAL LABORATORY TO ESTABLISH AN OFFICE OF RESEARCH AND TECHNOLOGY APPLICATIONS (ORTA)
- RECOMMENDED STAFFING AND FUNDING LEVELS FOR ORTA'S
- DELINEATED FOUR FUNCTIONS FOR ORTA'S
- REQUIRED BIENNIAL REPORTING THROUGH THE CENTER FOR THE UTILIZATION OF FEDERAL TECHNOLOGY IN COMMERCE DEPT.

TECHNOLOGY TO WIN

FEDERAL TECHNOLOGY TRANSFER ACT OF 1986

US ARMY
LABORATORY COMMAND

PRINCIPAL POINTS

- AMENDS THE STEVENSON-WYDLER ACT OF 1980
- STRENGTHENS POLICY WHICH MAKES TECHNOLOGY TRANSFER PART OF THE LAB MISSION
- REQUIRES THAT LABS WITH MORE THAN 200 S&E PERSONNEL HAVE A FULL TIME ORTA
- DEFINES ARMY, NAVY, AND AIR FORCE AS AGENCIES
- REQUIRES EACH AGENCY TO REPORT ANNUALLY WITH BUDGET SUBMISSION TO OMB
- EXPANDS NUMBER OF ORTA FUNCTIONS TO FIVE
- CHARTERS THE FEDERAL LABORATORY CONSORTIUM
- PROVIDES AUTHORITY FOR GOVERNMENT LABS TO ENTER INTO COOPERATIVE R&D AGREEMENTS
- PROVIDES 15% OF ROYALTIES TO INVENTORS AND THE MAJORITY OF THE BALANCE TO LABS

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TECHNOLOGY AND TECHNICAL ASSISTANCE

US ARMY
LABORATORY COMMAND

- TECHNICAL INFORMATION AND ASSISTANCE
  - DIRECT ASSISTANCE
  - REFERRAL TO OTHER FEDERAL LABS
- COOPERATIVE RESEARCH AND DEVELOPMENT AGREEMENTS
- PATENT LICENSES
  - EXCLUSIVE
  - NON-EXCLUSIVE

ARMY DOMESTIC TECHNOLOGY TRANSFER

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Director
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Director
U.S. Army Engineer Waterways Experiment Station
ATTN: CEWESFV-T (Mr. Philip Stewart)
P.O. Box 631
Vicksburg, MS 39181-0631

PHONE: (601) 634-4113
AV N/A
FAX: (601) 634-4180

Commander U.S. Army Aeromedical Research Laboratory ATTN: SGRD-UAX-SI (Ms. Diana Hemphill) P.O. Box 577 Ft. Rucker, AL 36362-5292	PHONE: (205) 255-6907 AV 558-6907 FAX: (205) 255-6937
Commander U.S. Army Medical Research Institute of Chemical Defense ATTN: SGRD-UV-R (Mr. Lloyd Roberts) Aberdeen Proving Ground, MD 21010-5425	PHONE: (301) 671-3628 AV 584-3628 FAX: (301) 676-7045
Commander U.S. Army Institute of Dental Research Walter Reed Army Medical Center ATTN: SGRD-UDR (Dr. Gino Battistone) Washington, D.C. 20307-5300	PHONE: (202) 576-3254 AV 291-2478 FAX: (202) 576-0518
Commander U.S. Army Institute of Surgical Research ATTN: SGRD-USX (LTC David Howard) Ft. Sam, Houston, TX 78234-5012	PHONE: (512) 221-2340 AV 471-2340 FAX: (512) 227-8502
Commander U.S. Army Letterman Army Institute of Research ATTN: SGRD-ULZ-IR (Mr. Jack Keller) Presidio of San Francisco, CA 94129-6800	PHONE: (415) 561-2641 AV 586-2641 FAX: (415) 561-4138
Commander U.S. Army Biomedical Research and Development Laboratory ATTN: SGRD-UBZ-RA (Mr. Lee Merrell) Ft. Detrick, MD 21701-5010	PHONE: (301) 663-2024 AV 343-2024 FAX: (301) 663-2569
Commander U.S. Army Medical Research Institute of Infectious Diseases ATTN: SGRD-UIZ-D (Dr. Michael Chirigos) Frederick, MD 21701-5010	PHONE: (301) 663-2227 AV 343-2227 FAX: (301) 663-2893
Commander U.S. Army Medical Research Institute of Environmental Medicine ATTN: SGRD-UEZ (MAJ Lawrence Lightner) Natick, MA 01760-5007	PHONE: (508) 651-4812 AV 256-4812 FAX: (508) 651-5298

Director
Walter Reed Army Institute of Research
ATTN: SGRD-UWZ-I (Mr. B. Nolan Dale)
Walter Reed Army Medical Center
Washington, D.C. 20307-5100

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AV 291-2274
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Commander
U.S. Army Armament Research, Development and Engineering Center
ATTN: SMCAR-AST (Mr. Robert Zanowicz)
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PHONE: (201) 724-6979
AV 880-6979
FAX: (201) 724-2934

- Close Combat Armaments Center
- Fire Support Armaments Center
- Armament Engineering Directorate

Commander
U.S. Army Chemical Research, Development and Engineering Center
ATTN: SMCCR-OPP (Ms. Susan Luckan)
Aberdeen Proving Ground, MD 21010-5423

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Director
U.S. Army Aviation Research, Development and Engineering Center
Aviation Research & Technology Activity
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Commander
CECOM Center for Command, Control and Communications Systems
ATTN: AMSEL-RD-C3-PB (Mr. Charles Grzenda)
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Commander
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ATTN: AMSEL-RD-EW-TS (Mr. Dennis Sanders)
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Commander
CECOM Center for Software Engineering
ATTN: AMSEL-RD-SE-AST (Mr. George Sumrall)
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FAX: (201) 544-2163

Director CECOM Center for Night Vision and Electro-Optics ATTN: AMSEL-RD-NV-SPD (Mr. Richard Fulton) Ft. Belvoir, VA 22060-5677	PHONE: (703) 664-4736 AV 354-4736 FAX: (703) 781-7124
Director CECOM Center for Signals Warfare ATTN: AMSEL-RD-SW-DT (Mr. G. W. (Bill) Mitchell) Vint Hill Farms Station Warrenton, VA 22186-5100	PHONE: (703) 347-6594 AV 299-6594 FAX: (703) 349-9085
Director U.S. Army Missile Command Research, Development and Engineering Center ATTN: AMSMI-RD-TI (Dr. Steven Smith) Redstone Arsenal, AL 35898-5243	PHONE: (205) 876-5449 AV 746-5449 FAX: (205) 876-9142
Director U.S. Army Tank-Automotive Command Research, Development and Engineering Center ATTN: AMSTA-CK (Mr. Robert Hostetler) Warren, MI 48397-5000	PHONE: (313) 574-5270 AV 786-5270 FAX: (313) 574-5952
Commander U.S. Army Belvoir Research, Development and Engineering Center ATTN: STRBE-IL (Ms. Connie Harrisson) Ft. Belvoir, VA 22060-5606	PHONE: (703) 664-1068 AV 354-1068 FAX: (703) 355-3739
Commander U.S. Army Natick Research, Development and Engineering Center ATTN: STRNC-EMP (Mr. Robert Rosenkrans) Natick, MA 01760-5014	PHONE: (508) 651-5296 AV 256-5296 FAX: (508) 651-4930
Director U.S. Army Research Office ATTN: SLCRO-TS (Mr. David Seitz) P.O. Box 12211 Research Triangle Park, NC 27709-2211	PHONE: (919) 549-0641 AV 935-3331 FAX: Ask for X284
Commander U.S. Army Atmospheric Sciences Laboratory ATTN: SLCAS-DP-P (Mr. Richard Himebrook) White Sands Missile Range, NM 88002-5501	PHONE: (505) 678-4917 AV 258-4917 FAX: (505) 678-2432

Director
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Director
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Devices Laboratory
ATTN: SLCET-DJ (Mr. Richard Stern)
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Director
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Director
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Director
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Director
U.S. Army Vulnerability Assessment Laboratory
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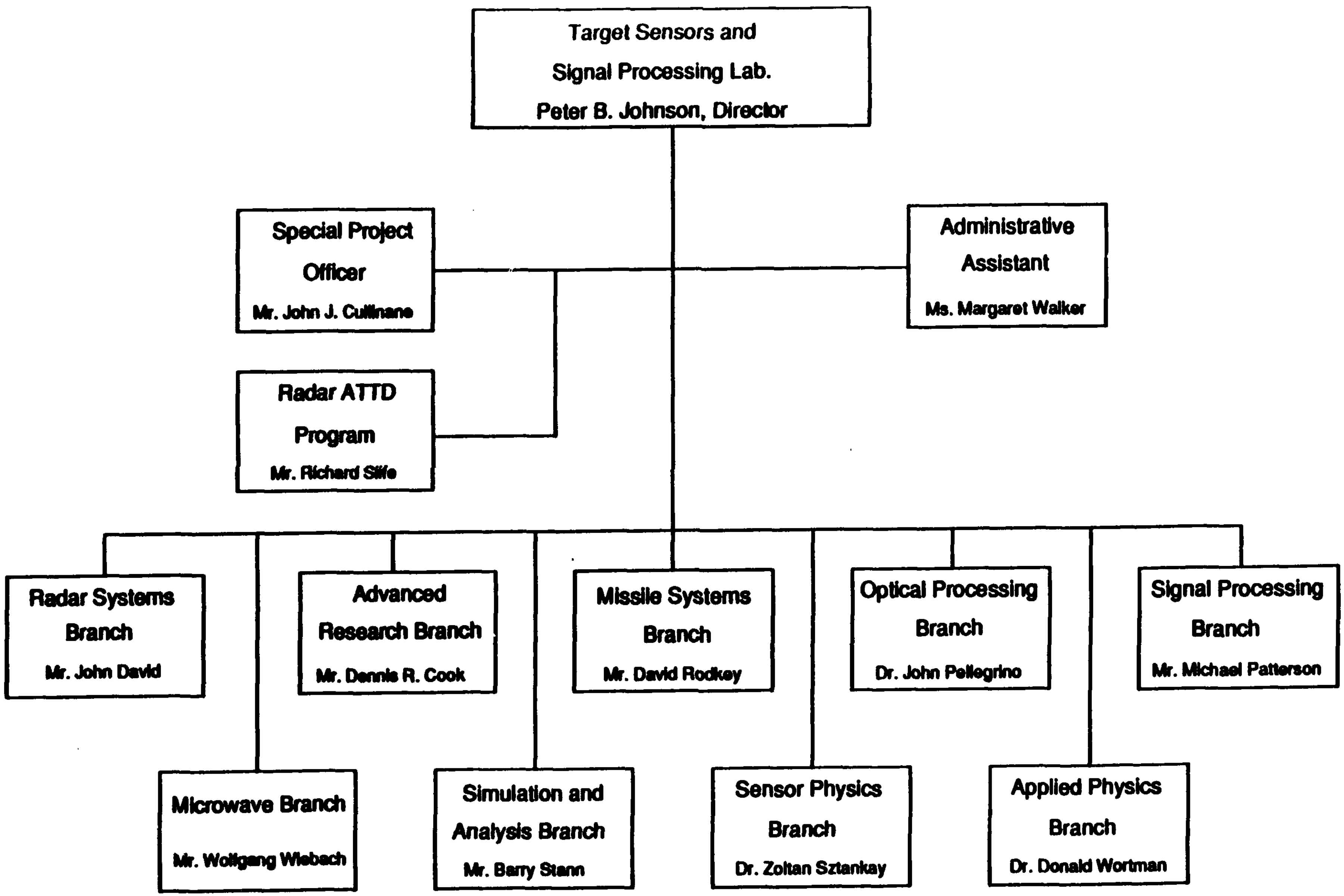
HARRY DIAMOND LABORATORIES

U. S. ARMY
LABORATORY COMMAND

Session III
Target Sensors and Signal Processing

Session Chairman:
Peter B. Johnson
Director, Target Sensors and Signal Processign Laboratory


Target Sensors and
Signal Processing Lab.
Peter B. Johnson, Director
Special Project
Officer
Mr. John J. Cullinane
Administrative
Assistant
Ms. Margaret Walker
Radar ATTD
Program
Mr. Richard Sllfe
Radar Systems
Branch
Mr. John David
Advanced
Research Branch
Mr. Dennis R. Cook
Missile Systems
Branch
Mr. David Rodkey
Optical Processing
Branch
Dr. John Pellegrino
Signal Processing
Branch
Mr. Michael Patterson
Microwave Branch
Mr. Wolfgang Wiebach
Simulation and
Analysis Branch
Mr. Barry Stann
Sensor Physics
Branch
Dr. Zoltan Sztankay
Applied Physics
Branch
Dr. Donald Wortman

TECHNOLOGY TO WIN

SENSOR TECHNOLOGY DESCRIPTION

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LABORATORY COMMAND

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PERFORM RESEARCH IN SENSOR TECHNOLOGY, BACKSCATTER MODELING AND SYSTEM DESIGN. INTEGRATE SENSOR RESEARCH WITH ADVANCED DIGITAL AND OPTICAL PROCESSING TECHNOLOGY INTO SMALL, LIGHT WEIGHT, LOW COST, SURVIVABLE SENSORS TO SUPPORT ARMY TACTICAL REQUIREMENTS FOR:

- SURVEILLANCE RADARS
- FUZE SENSORS
- ANTI-RADIATION MISSILE COUNTER MEASURE TECHNOLOGY

HARRY DIAMOND LABORATORIES

U. S. ARMY
LABORATORY COMMAND

Signal Processing Technology

Dr. John M. Pellegrino
Chief, Optical Processing
Technology Branch
Target Sensors and
Signal Processing Laboratory

TITLE: OPTICAL SIGNAL PROCESSING

TECHBASE INVESTMENT STRATEGY AREA: EMERGING TECHNOLOGIES - ADVANCED SIGNAL PROCESSING AND COMPUTING

Optical processing modules, combined with digital processing hardware, provide advanced, high-throughput processing capability for real-time applications. Such signal processing systems are for ground and air based missions involving radar processing, communications intercept, and target recognition.

DESCRIPTION

Develop optical processing modules with low weight, power consumption, and volume, possessing high throughput/high processing gain characteristics for real-time signal processing applications. Combined in hybrid testbed systems with digital and rf analog processing capabilities; demonstrations will encompass processing of wideband, complex radar and communications signals, and offer extensive processing capacity for image processing/ target recognition problems.

OBJECTIVE/APPROACH

The objective is to provide the battlefield commander with real time analysis and interception of the prevailing signal environment. Key optical devices, algorithms, and architectures, along with new electro-optic implementations are examined to enhance current signal processing capabilities.

Tech barriers are:

- Materials and Devices: Larger time apertures, greater efficiency
- Detector Arrays: Increased dynamic range in two dimensions
- Diode Lasers: Visible, high power, narrower linewidth
- Spatial Light Modulators: Higher resolution
- Sophisticated Algorithms and Architectures for Exotic Signal Types: Exploit parallel/multi-dimensional architectures for greater processing power
- Rugged, Compact Modular Units: More universal environmentally rugged designs
- System Interfaces: Greater compactness, increased processing power
- Advanced GaAs Optoelectronic Structure for Neural Networks

REMARKS

In direct support of:

- Integrated Intercept System
- Integrated Jammers
- Integrated Sensors
- Distributed IEW Fusion
- Intelligence and Electronic Warfare Vehicle

Technical POC: Mr. John Pellegrino
Telephone: (202) 394-2520

ARMY SIGNAL PROCESSING REQUIREMENTS

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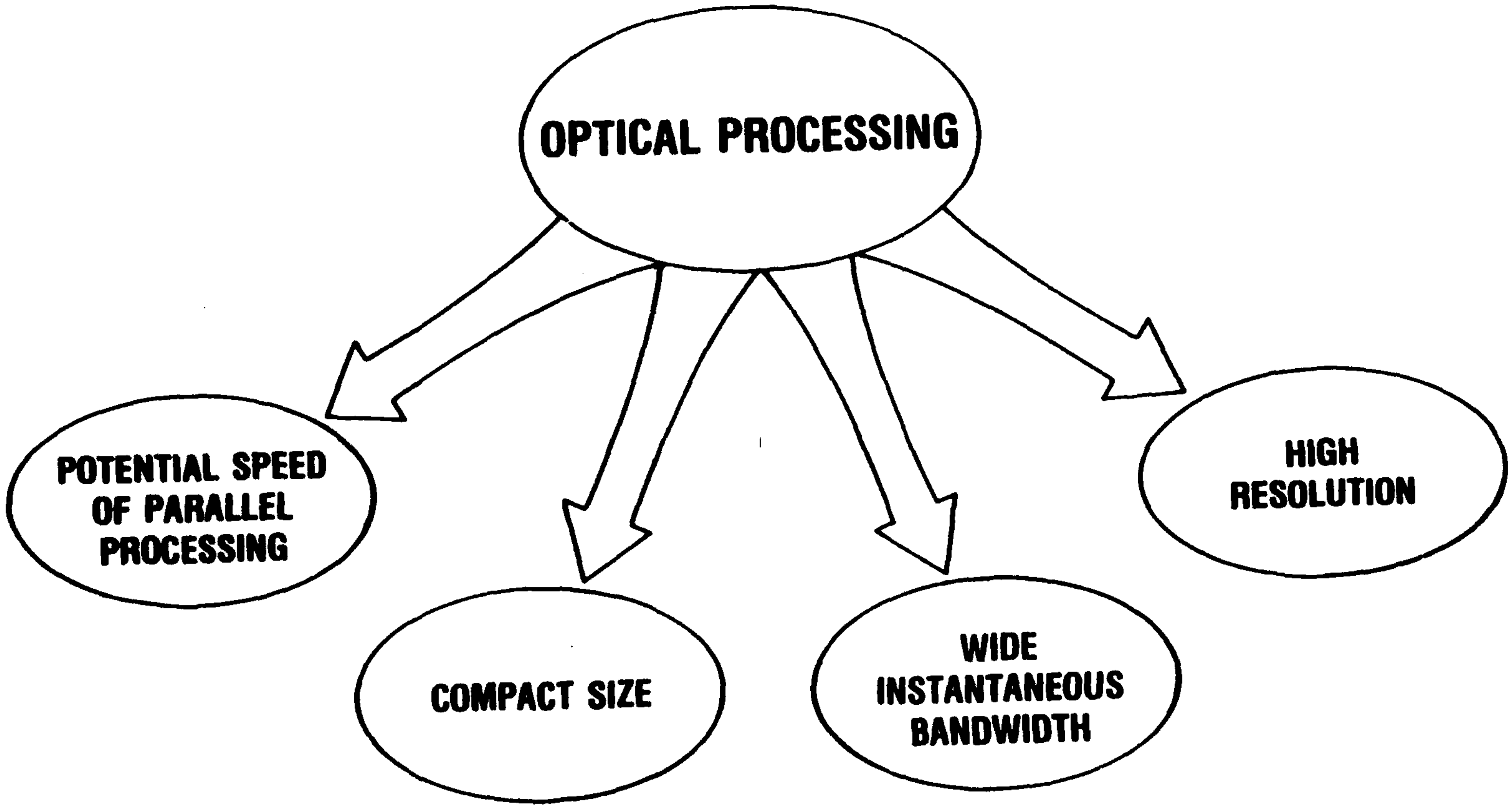
For the 1990's and beyond, signal processing systems designed for the Army's tactical applications must be able to handle large numbers of signals with exotic modulation types. This involves:

- Wide Bandwidth
- Fine Resolution
- Large Dynamic Range
- High Throughput
- Ultra Fast Update Capability
- Sophisticated Algorithms and Signal Recognition Capability
- Advanced Hardware for Sytem Interfacing

Processors must also be capable of operating over a wide range of environmental conditions [illegible] .uve size, weight, and power requirements app[illegible] [illegible]te for shelter-based and UAV-based implementation. Optical processors have dem[illegible]ated present and potential capability to address these issues.

OPTICAL SIGNAL PROCESSING

TASK: FAST, ACCURATE DETECTION AND PROCESSING OF WIDE BANDWIDTH SIGNALS WITH COMPACT HARDWARE



OPTICAL SIGNAL PROCESSING PROGRAM APPROACH

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** Support component development for Bragg cells, SLM's, laser diodes, photodetector arrays (one and two dimensional), and development of optically sensitive materials

** Support development of optical algorithms and architectures for rugged, compact modular building block processors and system interfaces

TECHNOLOGICAL BARRIERS COMPONENTS

KEY COMPONENT AREAS WHICH NEED DEVELOPMENT IN ORDER TO ENHANCE PROCESSOR SPECIFICATIONS AND SO MEET PROCESSING REQUIREMENTS:

MATERIALS:

III-V OPTOELECTRONICS

ACOUSTO-OPTIC, MAGNETO-OPTIC, ELECTRO-OPTIC,...

DEVICES:

HIGH POWER (>100mW) RED, SINGLE MODE LASER DIODES

HIGH RESOLUTION MODULATORS, ONE- AND TWO-DIMENSIONAL

HIGH DYNAMIC RANGE(>70dB), HIGH FRAME RATE(>100Hz) OPTICAL DETECTORS

TECHNOLOGICAL BARRIERS
ALGORITHMS AND ARCHITECTURES

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LABORATORY COMMAND
HARRY DIAMOND LABS

Key areas for optical processor development to enhance processing capabilities and so meet Army processing system requirements :

SOPHISTICATED ALGORITHMS AND ARCHITECTURES FOR EXOTIC SIGNAL TYPES

Currently high success with one-dimensional (and some 2-D) architectures; need to develop these further and exploit parallel/multi-dimensional nature of optics for greater processing power.

RUGGED, COMPACT MODULAR UNITS

Take application specific units and generalize to make more universal designs. Advanced architectures must also be environmentally rugged.

SYSTEM INTERFACES

Current electronic interfaces large; both digital and analog interfaces can be made much more compact and with greater processing power.

SIGNAL PROCESSING TECHNOLOGY VISION

LONG TERM PROSPECTS:

- Inherently parallel, high throughput, high bandwidth, small processing structures for a wide variety of applications
  - hybrid bulk/ integrated optics structures for multidimensional processing capabilities
  - optoelectronic integrated circuits (OEIC) for wideband processing
- III–V optoelectronics for neural networks
- Complementary use of optical/digital technology in systems

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Fuzing Technology

Dr. Z. G. Sztankay
Chief, Sensor Physics Branch
Target Sensors and
Signal Processing Laboratory

TITLE: FUZING TECHNOLOGY

TECH BASE INVESTMENT STRATEGY AREA

Emerging Technologies -- Protection/Lethality

Next Generation/Future Systems -- Deep-Fire Smart Munition
Median Surface-to-Air Missile
The Army Counter-Air Weapon System
Future Smart Munition
Long-Range Artillery Missile
Patriot 2000
LOS-F-H Block II
Multi-Mode Anti-Armor Weapon System

DESCRIPTION

This topic covers applied research and exploratory development on proximity fuze sensors for air defense and anti-armor applications. Because the bulk of the effort is focused on guidance-integrated fuzing, the terminal phase of missile guidance, including aim-point wander, is also a program focus. Technologies being investigated for air-target fuzing include rf, electro-optical, electrostatic, and millimeter wave guidance-integrated. The anti-armor program is focused on millimeter-wave guidance-integrated fuzing. Special problem areas are fuzing in a high clutter environment, countermeasures, and low-observable targets. Strong emphasis is placed on obtaining basic data on targets, clutter, and countermeasures, and on using the data to develop and validate computer models for encounter simulations used to develop and evaluate fuzing and terminal homing designs and algorithms.

OBJECTIVE/APPROACH

The objective is to meet new proximity fuzing requirements and reduce the cost of future proximity fuzes.

The approach and technology barriers are:

-- Clutter-Resistant Air-Target Fuzing: The current primary goal of this program is to provide proximity sensing against air targets near the tree line withc prefunctioning on clutter. Measurements have been and are being made of fol e and target returns with rf, electro-optical, and electrostatic sensors, and fuzi concepts are being evolved and tested. The threat of countermeasures, h as chaff and ECM for rf sensors and smoke for electro-optical sensors, mu continue to be overcome. Fuzing against low-observable targets will be a strong consideration in the future. Applications include FAADS-LOS-F-H, MSAM, TACAWS, Stinger Follow-On.

-- Guidance-Integrated Air-Target Fuzing: The goal of this program is to eliminate the need for a separate proximity fuze by obtaining the fuzing information from the guidance sensor. The current effort is concentrated on the 35-GHz active seeker program for Patriot. An instrumentation radar system is being developed for use in obtaining basic data during end-game encounter simulations against suitable targets. The data will yield target signatures and seeker aim points, and will be used to develop encounter models, which in turn will be used to conceive and evaluate seeker wave forms and algorithms that will yield minimum aim-point wander and optimum fuzing. ECM and chaff resistance and low-observable targets are also prime concerns. Future systems applications include MSAM.

-- Guidance-Integrated Anti-Armor Fuzing: This program is currently investigating the feasibility of using seeker information to provide standoff fuzing for advanced shaped-charge warheads on 95-GHz anti-armor smart weapons. Fully-polarimetric ISAR images and dual-plane monopulse seeker signals are being obtained and analyzed to predict and optimize seeker aim-points and to explore and develop fuzing concepts. Computer target models are being developed and will be used in end-game encounter simulations, and breadboard guidance-integrated standoff fuzing sensors will be developed and tested. Technology barriers include aim-point wander, different seeker and fuzing time constants, clutter, and countermeasures, especially target cross-section reduction. Potential applications are millimeter wave smart weapon seekers like MLRS-TGSM and APGM.

REMARKS

These programs are carried out in close cooperation with, and in some cases in direct support of, MICOM and ARDEC. Development and higher level funding originates with these and other non-LABCOM agencies.

Technical POCs:

-- Overall: Dr. Z. G. Sztankay Telephone 202-394-3130
RF and Electrostatic Clutter-Resistant Air-Target Fuzing:
Barry Stann Telephone 202-394-3140
Guidance-Integrated Air-Target Fuzing:
Dave Rodkey Telephone 202-394-2610
Guidance-Integrated Anti-Armor Fuzing:
Dr. Joseph Nemarich Telephone 202-394-3130

OUTLINE

- Clutter-Resistant Air-Target Fuzing

    RF

    Electro-Optical

    Electrostatic

- Guidance-Integrated Air-Target Fuzing

- Guidance-Integrated Anti-Armor Fuzing

OBJECTIVE

Address enhanced requirements for and reduce the cost of electronic fuzing sensors for air and ground targets. Required performance improvements are:

- Optimize burst point control
- Increase resistance to countermeasures
- Detect targets in clutter
- Detect low observable targets
- Increase reliability

CLUTTER-RESISTANT AIR-TARGET FUZING

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MAINTAIN LETHALITY OF AIR DEFENSE MISSILES AND PROJECTILES AGAINST MASKED TARGETS AND AVOID PREFIRE

TECHNICAL

CRITICAL TECHNOLOGY:
- TARGET/CLUTTER SIGNATURES • SIGNAL PROCESSING ALGORITHMS • ENCOUNTER SIMULATION • VHSIC/MIMIC

RISKS/PROBLEMS:
- LOW OBSERVABLES (L.O.) • PREFIRE ON CLUTTER • BURST POINT CONTROL • ECM • CHAFF • OBSCURANTS

RELATED PROGRAMS:
FAADS-LOS-F-H, MSAM, STINGER FOLLOW-ON, TACAWS TMAS, 30-MM AIR-TO-AIR CARTRIDGE

PERFORMING ORGANIZATIONS:
CONTRACTOR:
IN-HOUSE: HDL

PROGRAM MILESTONE SCHEDULE

MILESTONES	FY89	FY90	FY91	FY92	FY93	FY94
TGT. SIG. COLLECTION						
CLUTTER SIG. COLLECTION						
SIGNATURE ANALYSIS						
ALGORITHM DEVELOPMENT						
ENCTR. SIM. FOR L.O. TGT						

FUNDING ($M)

APPROPRIATION	FY89	FY90	FY91	FY92	FY93	FY94
RTDE FUNDED	0.8	0.7	0.8	0.7	0.9	1.2
UNFUNDED		0.4	0.4	0.5	0.3	0.3

LSTA0000-3M7

CLUTTER-RESISTANT AIR-TARGET FUZING

Barriers:

- Targets in Clutter
- Countermeasures
  - Chaff, ECM, Smoke
- Low-Observable Targets

Approach:

- Various Sensor Technologies
- Obtain Basic Data
  - Clutter, Targets, Countermeasures
- Develop Computer Models for Encounter Analysis
- Conceive and Analyze Concepts
- Build and Test Breadboards

GUIDANCE-INTEGRATED AIR-TARGET FUZING

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LABORATORY COMMAND

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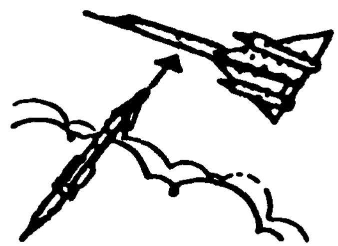
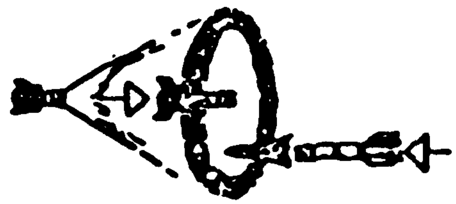
HIMADS



ATM



IMPROVE LETHALITY AND REDUCE COST OF AIR DEFENSE MISSILES

TECHNICAL

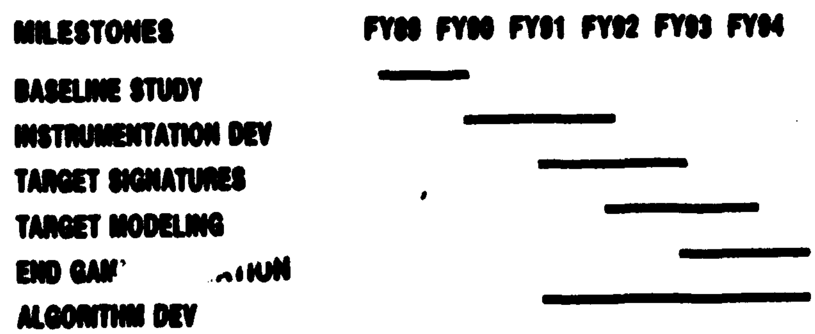
CRITICAL TECHNOLOGY:
- SEEKER SENSORS • SIGNAL PROCESSING ALGORITHMS
- AIMABLE WARHEADS • VHSIC/MIMIC • LOW OBSERVABLES

RISKS/PROBLEMS:
- SENSOR SELECTION • DISCRIMINATE TARGET FROM CLUTTER • ECM RESISTANCE • ORGANIZATIONAL SEPARATION

RELATED PROGRAMS:
PATRIOT, HAWK/MSAM

PERFORMING ORGANIZATIONS:
CONTRACTOR: HAC, RAYTHEON
IN-HOUSE: HDL, MICOM

PROGRAM MILESTONE SCHEDULE



FUNDING ($M)

APPROPRIATION	FY89	FY90	FY91	FY92	FY93	FY94
RTDE FUNDED	0.1	0.3	0.4	0.3	0.4	1.0
UNFUNDED	1.7	0.3	[illegible]	.3	0.2	0.3

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AIR TARGET GIF
BASIC CONCEPT

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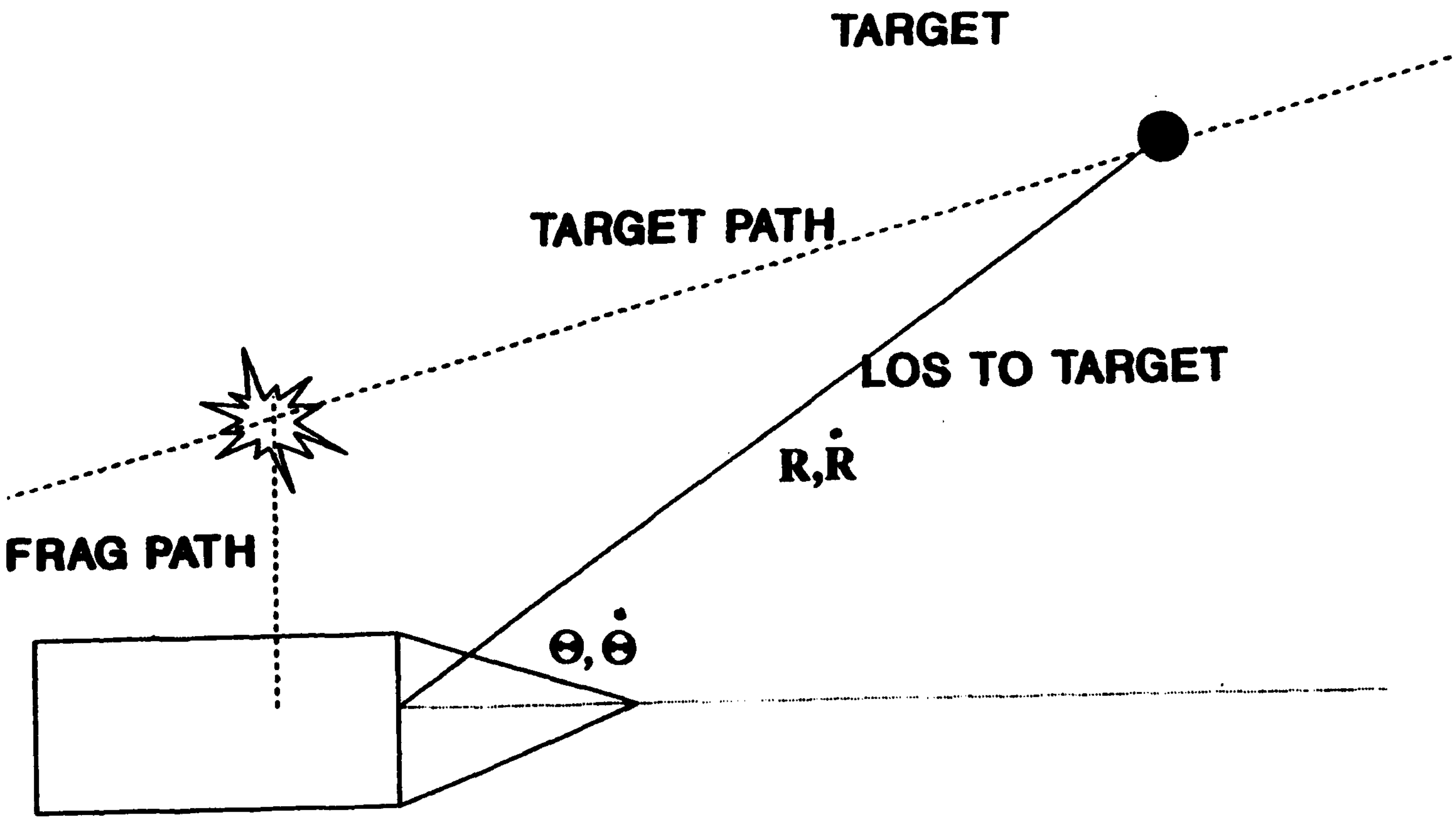
LABORATORY COMMAND



GUIDANCE-INTEGRATED ANTI-ARMOR FUZING

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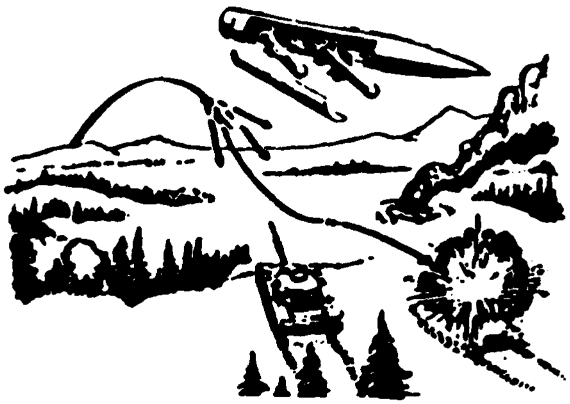
HARRY DIAMOND LABORATORIES



LETHALITY REQUIRES MAXIMIZING WARHEAD, REDUCING FUZE SPACE & WEIGHT ALLOCATIONS, OPTIMIZING AIMPOINT

TECHNICAL

CRITICAL TECHNOLOGY:
- TARGET/CLUTTER SIGNATURES • ENCOUNTER SIMULATION
- SIGNAL PROCESSING ALGORITHMS • AIM POINT ALGORITHMS
- VHSIC/MIMIC

RISKS/PROBLEMS:
- SENSOR SELECTION • DISCRIMINATE TARGET IN CLUTTER
- ECM RESISTANCE • ORGANIZATIONAL SEPARATION

RELATED PROGRAMS:
MLRS-TGW, NATO 155/COPPERHEAD III

PERFORMING ORGANIZATIONS:
CONTRACTOR:
IN-HOUSE: HDL

PROGRAM MILESTONE SCHEDULE

MILESTONES	FY89	FY90	FY91	FY92	FY93	FY94
INSTRUMENTATION DEV						
SIGNATURE COLLECTION						
MODELING/SIMULATION						
SEEKER/FUZE BREADBOARD						
FLIGHT TEST ANALYZE						

FUNDING ($M)

APPROPRIATION	FY89	FY90	FY91	FY92	FY93	FY94
RDTE FUNDED	0.5	0.5	1.3	1.2	1.7	0.9
UNFUNDED		0.5	0.5	0.6	0.3	0.2

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MMW ANTI-ARMOR SEEKER SCENARIO

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LABORATORY COMMAND

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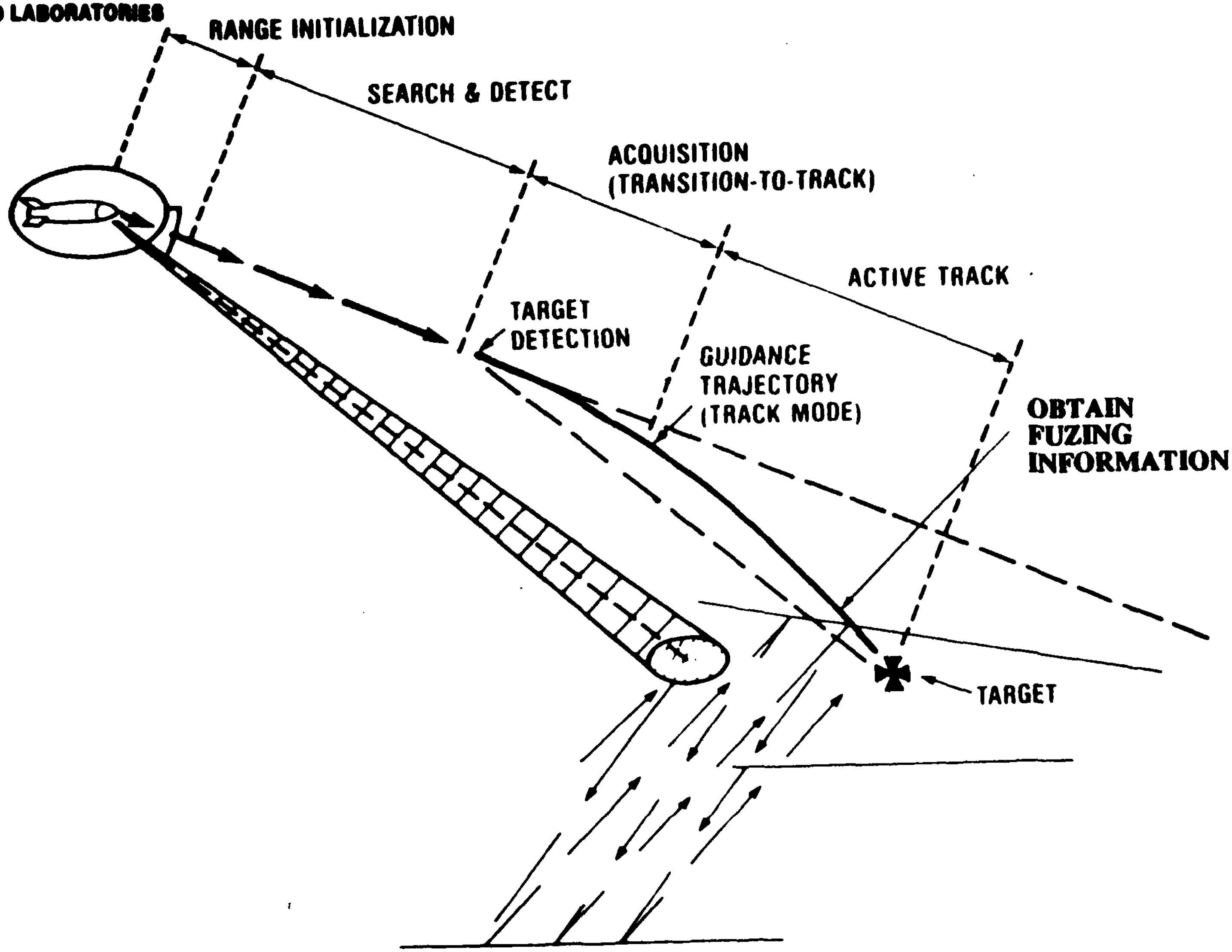

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U. S. ARMY
LABORATORY COMMAND

Radar Technology

John M. David
Chief, Radar Branch
Target Sensors and
Signal Processing Laboratory

TITLE: RSTA Radar Technology

TECHBASE INVESTMENT STRATEGY AREA: Next Generation/Future Systems

DESCRIPTION:

Radar technology that:

a. improves all weather detection, location, classification and identification of targets employing camouflage, concealment and deception;

b. enhances platform survivability and reduces sensor susceptibility; and

c. reduces system cost, weight, prime power or enhances reliability and maintainability.

OBJECTIVE/APPROACH:

To provide radar technology that meets the requirements of Next Generation/Future Systems. A phased approach will be used where Phase I is primarily analysis leading to concept definition. Phase II involves implementation and evaluation of concept testbeds, and Phase III will transition the technology to Army Research Development and Engineering Centers.

TECHNICAL BARRIERS:

New concepts and components are required that provide a significant enhancement in radar technology to meet the requirements of the Next Generation/Future Systems.

TECHNICAL POCs: John David or Barry Schiener
Harry Diamond Laboratories
ATTN: SLCHD-ST-R
2800 Powder Mill Road
Adelphi, MD 20783-1197

Telephone: (301) 394-2530

<u>HDL RSTA RADAR CHARTER</u>.

- PURSUE RADAR TECHNOLOGY NEEDED FOR THE ARMY'S NEXT GENERATION/FUTURE SYSTEMS.
- TRANSITION THE TECHNOLOGY TO THE ARMY'S RD&ECS.

TECHNOLOGY GOALS.

- RADAR TECHNOLOGY THAT IMPROVES ALL WEATHER DETECTION, LOCATION, CLASSIFICATION, AND IDENTIFICATION OF TARGETS EMPLOYING CAMOUFLAGE, CONCEALMENT, AND DECEPTION.
- RADAR TECHNOLOGY THAT ENHANCES PLATFORM SURVIVABILITY AND REDUCES SENSOR SUSCEPTIBILITY.
- RADAR TECHNOLOGY THAT REDUCES SYSTEM COST, WEIGHT, AND PRIME POWER OR ENHANCES RELIABILITY AND MAINTAINABILITY.

CURRENT INTEREST.

- RSTA OF PERSONNEL, GROUND VEHICLES AND LOW AND SLOW A/C.
- ENHANCED PLATFORM SURVIVABILITY AND REDUCED SENSOR SUSCEPTIBILITY.
- BURIED MINE DETECTION.

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ACTIVE PROGRAMS.

- EVALUATION OF STATIONARY RADARS FOR SURVEILLANCE AND TARGET ACQUISITION OF MOVING PERSONNEL, GROUND VEHICLES, AND HELICOPTERS.
- EVALUATION OF MOVING RADARS FOR SURVEILLANCE AND TARGET ACQUISITION OF MOVING GROUND VEHICLES AND HELICOPTERS.
- DETECTION OF STATIONARY TARGETS CONCEALED IN FOLIAGE.
- EVALUATION OF SEVERAL MULTISTAGE PROCESSING AND CFAR CONCEPTS.
- ANALYSIS OF 3D SAR CONCEPT.
- ANALYSIS OF MULTISTATIC CONCEPTS.

APPROACH.

- COMPONENTS. PURCHASE ONE OR TWO FOR EVALUATION AS A MODULE OR AS PART OF A SYSTEM.

- CONCEPTS.
  - o DETAIL REVIEW BY HDL
  - o PHASED PROGRAM
    - oo PHASE I. COOPERATIVE PROGRAM WITH HDL WITH LIMITED FUNDING TO DEFINE CONCEPT.
    - oo PHASE II. IMPLEMENTATION AND EVALUATION OF CONCEPT TESTBEDS.
    - oo PHASE III. TRANSITION TO ARMY RD&ECS.

SELECTION CRITERIA.

- APPLICABILITY TO TECHNOLOGY GOALS.
- APPLICABILITY TO CURRENT INTEREST.
- PAYOFF.
- PROBABILITY OF SUCCESS.

RADAR RSTA TECH BASE CONTRACT FUNDING.

FY90	91	92	93	94
0	250K	750K	1000K	1000K

- FY90 AND 91 FUNDING OUTLOOK IS NOT GOOD.
- IT WILL CHANGE.

Session IV
Engineering and Technical Support

Session Chairman:
Ira R. Marcus
Director, Technical Support Laboratory

TITLE **TECHNICAL SUPPORT ACTIVITIES AT HDL**

The HDL performs a variety of inhouse technical activities to support its ongoing technical projects. The activities are in the general area of mechanical parts and electronics fabrication, environmental testing, field testing, S&E computer automation, product assurance, integrated logistical support, configuration management and special programs including manufacturing studies. Most fabrication programs are for prototype quantities and facilities are therefore configured for quick response and for flexibility.

To operate these facilities efficiently and smoothly it is necessary for HDL to procure supplies, equipment and materials for daily operation and to keep them modern through the procurement of modern equipment and software.

Points of contact for each area are as follows:

Mechanical Fabrication:	Harry Hill	301-394-3124
Electronic Fabrication:	Albert Lee	301-394-2820
Environmental Testing:	Ami Frydman	301-394-2804
Field Testing:	Ed Carney	301-394-2434
S&E Computer Automation:	Robert Rosen	301-394-2917
Product Assurance, ILS, Configuration Mgt:	John Maristch	301-394-2230

Specific capabilities of each of these support areas are as follows:

MECHANICAL FABRICATION

General Fabrication	Special Fabrication	Specialty Areas
Lathes	Optical Line Tracing	Wood/Plastic
Mills	Ultrasonic Machining	NC Programming
Drills	Electrical Discharge	Grinding
Grinders	Plastic Molding	Plating
Sheet Metal		Mech Inspection
Welding		Heat Treating
NC Machining *		Tool Crib
		Metal Stores

* Nine Numerical Control Machines (Three Mills. three Lathes. one EDM Machine, one Sheet Metal Punch and one Drill)

ELECTRONIC FABRICATION

CAD
- PC Design
  - Manual
  - Automatic
  - Mask Fab
  - Drill In Drawings
- Wire Wrap
  - Tape Preparation
  - Reports

Printed Circuits
- Photographic
  - Step & Repeat
- Wet Chemistry
- Drill/Profile
- Multi-layer

Hybrid/thick films
- Design
- Fabrication
- Packaging
- Test
- Parylene Coat

Assembly
- General Fab
- Wire Wrap
- Encapsulate
- Inspection
- Test

ENVIRONMENTAL TEST AND SIMULATION

CLIMATIC TEST
- Temperature
- Humidity
- Altitude
- Salt Spray
- Waterproofness

DYNAMIC TEST

LOW SHOCK
- Jolt
- Tumble
- Free Fall
- Complex Signal
  - Shock Spectrum

VIBRATION
- Flight (Random)
- Transportation/
  - Vibration
  - Sine, Random
- 3-D Vibration**

CENTRIFUGAL

HIGH SHOCK*
- Interior
  - Angular
    - Acceleration
  - Balloting
- Transitional
  - Muzzle Exit
- Exterior
  - Spin
  - Spin Decay
  - Drag
- Terminal
  - Approach
    - Sensitivity
  - Impact
  - Delay after impact
  - Graze impact

* High Shock environments are simulated using a unique set of air guns built into our building, one gun is 300 feet long and has an eight inch bore.

** The 3-D vibration facility is a recent innovation.

DEMONSTRATION AND FIELD TESTING

The HDL Demonstration Support and Field Testing branch works at Army Proving Grounds located in the continental United States, Alaska, Panama, and overseas locations. Local testing is at the HDL Blossom Point Test area in southern Maryland. The Branch has facilities to support the following activities:

- Fuze Explosive Loading and Downloading
- Explosive Storage
- Fuze Explosive Laboratory Testing
- Range Firing
- Range Support
- Special Range Testing
- Data Acquisition
  - Electronic-Fleet of Data Acquisition Trucks
  - Photographic-High Speed video and Movies
- Data Reduction-Telemetry
- Helicopter Drop Tests

SCIENTIFIC AND ENGINEERING AUTOMATION SERVICES

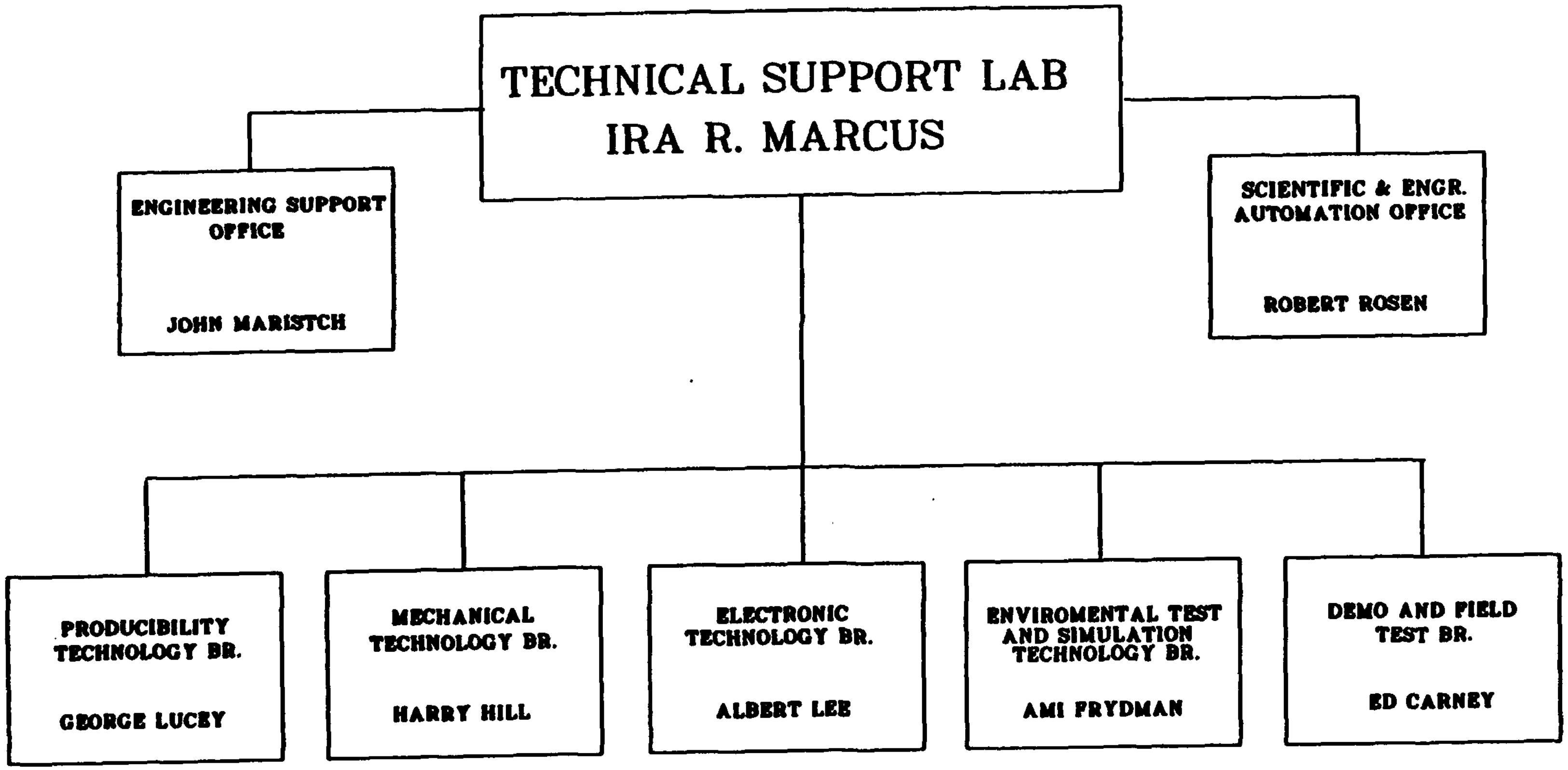
The S & E Automation Services group provides technical computer services to all HDL scientists and engineers. This group maintains and operates a VAX 8800 computer which is available to the HDL staff via an in-house network. A current facilities project of this group is the design and procurement of an HDL-wide Local Area Network. Their most recent accomplishment has been the successful procurement of the LABCOM IBM mainframe. The primary mission of the this group is special computer programming assistance to S & E's. Equipment capability is focused on interactive computer graphics.

PRODUCT ASSURANCE, INTEGRATED LOGISTIC SUPPORT, AND CONFIGURATION MANAGEMENT

This office provides Product Assurance, ILS, and CM services to HDL development and production programs. Recent facilities improvements have been the acquisition of QA instrumentation to support the office. The primary facilities of this office is the data repository which house HDL's Technical Data Packages. Complete storage and reproduction equipment complements the management of the TDP's. Current activities are to transfer our 150,000 drawings to the Army's new DESREDS optical storage system.

HARRY DIAMOND LABORATORIES
TECHNICAL SUPPORT LAB

US ARMY
LABORATORY COMMAND
HARRY DIAMOND LABS



MECHANICAL TECHNOLOGY BRANCH

HARRY HILL, CHIEF

GENERAL FABRICATION	SPECIAL FABRICATION	SPECIALTY AREAS
LATHES	N.C. MACHINING	PRECISION SHEET-METAL (METAL JOINING)
MILLS	ULTRASONIC MACHINING (HARD, BRITTLE)	NON METALLIC FABRICATION
DRILL PRESSES	ELECTRICAL DISCHARGE (SPARK EROSION)	PLASTIC MOLDING (AND DIE MAKING)
GRINDERS	OPTICAL LINE TRACER	GRINDING
		PLATING
		MECHANICAL INSPECTION
		METAL STORES
		TOOL CRIB
		HEAT TREATING

ELECTRONIC TECHNOLOGY BRANCH

ALBERT LEE, CHIEF

COMPUTER AIDED DESIGN

- P.C. DESIGN
  - MANUAL LAYOUT
  - AUTOMATIC LAYOUT
  - MASK GENERATION
  - DRILL TAPE PREPARATION
  - DRAWINGS
- WIRE WRAP
  - CONTROL TAPE PREPARATION
  - REPORTS

PRINTED CIRCUIT FABRICATION

- PHOTOGRAPHIC REDUCTION STEP AND REPEAT
- WET CHEMISTRY—ETCHING—PLATING
- BOARD DRILLING & PROFILING
- MULTILAYER BOARDS

HYBRID-THICK FILM

- DESIGN
- FABRICATION
- PACKAGING
- PARYLENE COATING

ASSEMBLY

- CUSTOM FABRICATION
- WIRE WRAPPING
- ENCAPSULATION
- PARTS HI-G QUAL.
- INCOMING INSPECTION
- BOARD TESTING
- WAVE SOLDERING

ENVIRONMENTAL TEST AND SIMULATION TECHNOLOGY BRANCH

AMI FRYDMAN, CHIEF

TECHNOLOGY TO WIN

HARRY DIAMOND LABORATORIES

US ARMY
LABORATORY COMMAND

CLIMATIC

- TEMPERATURE
- HUMIDITY
- ALTITUDE
- SALT SPRAY
- WATERPROOFNESS

CAN ARRANGE FOR

- DESERT (DUST)
- FUNGUS
- VACUUM-STEAM-PRESSURE

DYNAMIC

LOW SHOCK

- JOLT
- TUMBLE
- FREE FALL
- COMPLEX SIGNAL
- SHOCK SPECTRUM

VIBRATION

- FLIGHT (RANDOM)
- TRANSPORTATION/ VIBRATION SINE, RANDOM
- 3-D VIBRATION

CENTRIFUGAL

PUSH/PULL/BEND – MATERIALS

HIGH SHOCK

- INTERIOR
  - ANGULAR ACCELERATION
  - BALLOTING
- TRANSITIONAL
  - MUZZLE EXIT
- EXTERIOR
  - SPIN
  - SPIN DECAY
  - DRAG
- TERMINAL
  - APPROACH SENSITIVITY MEASUREMENTS
  - IMPACT
  - DELAY AFTER IMPACT
  - GRAZING IMPACT

DEMO AND FIELD TEST BRANCH

ED CARNEY, CHIEF

Data Acquisition

Electronic – Fleet of Trucks
Photographic – High Speed Video and Movies

Data Reduction
Range Firing – Blossom Point
Range Support – Yuma Rep.
Special Setups – Blossom Point
Explosive Loading and Downloading
Explosive Storage
Explosive Testing
Helicopter Tests

S&E AUTOMATION OFFICE

ROBERT ROSEN, CHIEF

VAX 8800 Computer Services for S&E's

Special Programming Assistance

HDL Local Area Network – Procurement

ENGINEERING SUPPORT OFFICE

JOHN MARISTCH, CHIEF

US ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

Product Assurance

Integrated Logistical Support

Configuration Management Drawing Vault

PRODUCIBILITY TECHNOLOGY BRANCH

GEORGE LUCEY, CHIEF

MAJOR PROGRAMS

TRAFFIC JAM

MMT – Soldering

Support to DCS for Production, AMC

U. S. ARMY
LABORATORY COMMAND

HARRY DIAMOND LABORATORIES

Automated Assembly of Electronics Circuits

George K. Lucey
Chief, Systems Engineering Branch
Technical Support Laboratory

TITLE: AUTOMATED ASSEMBLY OF ELECTRONIC CIRCUITS

TECHBASE INVESTMENT STRATEGY AREA

The Harry Diamond Laboratories is the LABCOM activity responsible for the U.S. Army Manufacturing Methods and Technology (MMT) Soldering Technology Program. MMT supports the LABCOM Producibility Mission, but is separate and distinct from the Tech Base. One HDL intent is to integrate areas of common interest, such as:

Systemic Issues:	Manufacturing Science	(I005)
Supporting Capabilities:	Special Purpose Equipment	(S005)
	Modeling and Simulation	(S002)
	Test and Evaluation	(S004)
Emerging Technologies:	Robotics	(E002)
	Artificial Intelligence	(E001)
	Advanced Materials	(E005)
	Advanced Signal Processing	(E006)
Next Generation Systems:	All electronics manufactured to soldering standards; e.g.	
	PATRIOT	(N057)
	SADARM	(N053)

DESCRIPTION

The DoD ManTech Program provides a means for the Tri-Services and the Defense Logistics Agency to invest in new manufacturing technologies which are essential to the affordability and quality of DoD products. These investments are made to agencies within both government and industry, but they focus on items of unacceptable risk to private investors. The Army program strategy (entitled Year-2010) is to establish Thrust Areas that emphasize issues identified in the DoD Critical Technologies Plan. Soldering Technology occupies the foreground in the electronics discipline within this plan, and the Harry Diamond Laboratories is the responsible agency within the U.S. Army Laboratory Command.

OBJECTIVE/APPROACH

The objective of the Soldering Technology Program is to improve the affordability and quality (producibility) of electronic systems on a national rather than a program basis. The approach is to establish a Joint Service center of excellence at the U.S. Navy NAVSEA Naval Weapons Support Center, Crane, Indiana, as a high-tech focal point of Tech Base scientists nationwide to interact with the production, quality, development, and standardization communities and thereby more effectively: 1) Introduce producibility considerations into next generation weapons systems; and 2) Resolve gaps in manufacturing science

which are currently inhibiting producibility of electronic systems. Examples of science issues relevant to the manufacturing cost of electronic systems are as follows: 1) Component solderability is presently gauged by dipping sample leads into solder and performing subjective visual inspection for anomalies. X-Ray spectroscopy could automate the process and remove subjectivity by measuring inhibiting intermetallics such as Cu_3Sn; 2) Wetting after soldering is presently gauged by visual inspection of the angle of solder contact. An automated and quantitative approach may be to use X-Ray for detecting the presence of intermetallics that signify chemical bonding, such as Cu_6Sn_5; 3) The significance of manufacturing anomalies that occur in the assembly of electronic components is presently gauged by subjective visual inspection for defects perceived as risks to reliability. An automated approach may be to use 3-D Laser Imaging to detect the occurrence of anomalies and them automatically generate 3-D Finite Element computer models that calculate significance relative to field loading.

Roughly two million dollars will be invested yearly in MMT activities that require a complete understanding of X-Ray theory, lasers, electronic controllers, computers, robotics, etc. Contracting for scientific studies and one-of-a-kind machines will emphasize the Small Business 8A Set-Aside Program, Value Engineering Program, Army Research Office Scientific Services Program, and Engineering Services clauses of existing contracts. Cooperative exchanges which do not involve funding will utilize the Technology Transfer Program.

REMARKS

Soldering Technology currently does not have a strong scientific foundation. A zero-defect philosophy based upon perceptions of risk to field reliability has instead been imposed upon the electronics manufacturing industry. The national cost is billions of dollars yearly, and changes in these business practices will not be resolved by MMT funding. Contractors with common interests are encouraged to participate as consortium, avoid duplication of effort, and share resources, planning, facilities, etc.

Technical POC: Mr. George Lucey
Telephone: (202) 394-2680

OVERVIEW

- ARMY MANTECH PROGRAM
- HDL ROLE
- INDUSTRY OPPORTUNITIES

MANTECH

PERMITS THE TRI-SERVICES TO INVEST IN MANUFACTURING TECHNOLOGIES THAT ARE CRITICAL TO DOD PRODUCTION BUT ARE OF UNACCEPABLE RISK TO INDUSTRY INVESTMENT

ARMY MANTECH PROGRAM

- o WEAPONS COSTS ARE GROWING
- o NEW BUSINESS PRACTICES NEEDED
- o AMC HAS A MANTECH INITIATIVE
  - FOCUS ON CRITICAL TECHNOLOGIES
  - REMOVE MANAGEMENT LAYERS

HDL ROLE

US ARMY MMT THRUST AREA

FOR

SOLDERING TECHNOLOGY

FOCUS

NATIONALLY PERVASIVE

ELECTRONICS MANUFACTURING PROBLEMS

REQUIRING WORLD CLASS SCIENTISTS

USING HIGH-TECH FACILITIES

INVESTMENT PLANS

$ 2 MILLION YEARLY

BUSINESS OPPORTUNITIES

INTRODUCE TO ARMY PRODUCTION LINES
NEW AUTOMATION TECHNOLOGIES NOT NOW
INCLUDED IN SOLDERING STANDARDS

GUIDELINES

DE-EMPHASIZE VISUAL INSPECTION

FOCUS ON PROCESS CONTROLS

CRITICAL TO FIELD RELIABILITY

BUSINESS OPPORTUNITIES

- PROCESS MONITORS AND CONTROLS
- COMPUTER NETWORKING
- SOLDERABILITY
- WETTING
- CFC CLEANERS
- ANALYTICAL DESIGN TOOLS

CONCLUSION

MANUFACTURING SCIENCES MUST BE IMPROVED TO REDUCE COST OF ELECTRONIC ASSEMBLIES

SMALL BUSINESS

US ARMY
LABORATORY COMMAND

PROGRAM HISTORY

SMALL BUSINESS ACT – 1953
- –Started program – "Fair Share"
- –Created Small Business Administration
- –1958 Amendment – 8(a) Minority Business Assistance

P L 95–507 – Major Revision
- –Required Subcontract Goals
- –Explanation to congress on goal achievement
- –Small purchase set aside

P L 99–661 – Defense Authorization Act Section 1207
- –5% Goal – Disadvantaged Business
- –5% Objective – HBC/MI
- –Pay 10% above Fair Market price

US ARMY
LABORATORY COMMAND

WHO IS SMALL

Type of Business	Not to Exeed
Construction SIC 1521	$17 million/yr.
R&D SIC 8731	500 employees
Engineering Services SIC 8711	$13.5 million/yr.
Computer Programming SIC 7371	$7.0 million/yr.
Service – N.E.C.	$3.5 million/yr.
Manufacturing Industries – N.E.C.	500 employees

US ARMY
LABORATORY COMMAND

SMALL BUSINESS

PROGRAM HISTORY (CON'T)

P L 100–180 – Section 806 – Defense Authority Act

- –Small Disadvantaged Business Set Asides
- –Maintain 8(a) Level/SDB – 50% cost
- –Additional SADBU duty – HBCU/MI

P L 100–656 – "Business Opportunity Development Reform Act of 1988"

- –Major change – Micro management
- –5% goal applicable Government–wide
- –Liquidated damages – Subtract plan
- –SBA Right of Appeal on 8(a) contracting
- –9 year 8(a) term

US ARMY
LABORATORY COMMAND

CATEGORIES

TOTAL SMALL BUSINESS

SMALL BUSINESS SET–ASIDES

DISADVANTAGED BUSINESS

SMALL BUSINESS RESEARCH AND DEVELOPMENT

WOMAN OWNED BUSINESS

SMALL BUSINESS SUB–CONTRACTING

DISADVANTAGED BUSINESS SUB–CONTRACTING

HISTORIC BLACK COLLEGES UNIVERSITIES/MINORITY INSTITUTIONS

SMALL AND DISADVANTAGED BUSINESS PROGRAM FISCAL YEAR 1989

US ARMY
LABORATORY COMMAND

TOTAL DOLLARS	$296M
TOTAL SMALL BUSINESS (%)	24.6%
SMALL BUSINESS SET-ASIDE (%)	10.3%
DISADVANTAGED BUSINESS (%)	4 .5%
SMALL BUSINESS RESEARCH &DEVELOPMENT (%)	16.7%
WOMAN OWNED BUSINESS (MILLIONS)	$1.1M
HISTORIC BLACK COLLEGES & UNIVERSITIES /MINORITY INSTITUTIONS	1.4%

U. S. ARMY
LABORATORY COMMAND

Industrial Liaison Programs

Melvyn J. Shichtman
Technical and Industrial Liaison Officer
U.S. Army Laboratory Command
AMSLC-CM
(202) 394-3880

INFORMATION FOR INDUSTRY

US ARMY
LABORATORY COMMAND

IF YOU FIRST FIND OUT ABOUT IT

IN THE COMMERCE BUSINESS DAILY

IT'S TOO LATE

ARMY INFORMATION FOR INDUSTRY

US ARMY
LABORATORY COMMAND

WHAT'S IN IT FOR INDUSTRY?

- FEWER BLIND ALLEYS
- MORE EFFICIENT MARKETING
- VECTORED IR&D
- MORE UNSOLICITED PROPOSAL WINNERS
- SUPPORT FOR STRATEGIC PLANNING

REGULATORY JUSTIFICATION

US ARMY
LABORATORY COMMAND

Army Regulation 70–35

Research, Development, and Acquisition

Information For Industry Programs

Headquarters
Department of the Army
Washington, DC

PROPONENT: ASSISTANT SECRETARY OF THE ARMY (RESEARCH, DEVELOPMENT, AND ACQUISITION) SARD–TN

EXECUTIVE AGENT:
U.S. ARMY MATERIEL COMMAND
OFFICE OF THE DEPUTY CHIEF OF STAFF FOR TECHNOLOGY PLANNING & MANAGEMENT
AMCLD–TI

US ARMY
LABORATORY COMMAND

TECHNICAL & INDUSTRIAL LIAISON OFFICES

"T I L O" = ONE-STOP SHOPPING

- ADVANCE PLANNING INFORMATION
- DESCRIPTIVE INFORMATION
- MATCH-MAKING
- UNSOLICITED-PROPOSAL GUIDANCE
- POTENTIAL CONTRACTOR PROGRAM
- R&D UNFUNDED STUDIES
- BROAD AGENCY ANNOUNCEMENTS
- SMALL BUSINESS INNOVATION RESEARCH
- HAND-OUTS

ARMY INFORMATION FOR INDUSTRY

US ARMY
LABORATORY COMMAND

TOPICS COVERED—

- TECHNICAL & INDUSTRIAL LIAISON OFFICES
- ARMY POTENTIAL CONTRACTOR PROGRAM
- R&D UNFUNDED STUDIES
- UNSOLICITED PROPOSALS
- BROAD AGENCY ANNOUNCEMENTS
- SMALL BUSINESS INNOVATION RESEARCH
- ADVANCE PLANNING BRIEFINGS FOR INDUSTRY
- TECHNOLOGY SYMPOSIA
- INDUSTRY DAYS
- TECHNICAL OBJECTIVE DOCUMENTS
- COMPETION ADVOCATES
- SMALL & DISADVANTAGED BUSINESS UTILIZATION
- CHALLENGE TO INDUSTRY

POTENTIAL CONTRACTOR PROGRAM

US ARMY
LABORATORY COMMAND

BENEFITS

- CERTIFICATION OF NEED–TO–KNOW
- SPONSORSHIP WITH DTIC
- LISTING IN DLA'S DISSEMINATION AUTHORITY LIST
- ACTS IN LIEU OF AN ACTIVE DOD CONTRACT
  - REGISTRANTS MAY RECEIVE INFORMATION
  - BASIS FOR OBTAINING CLEARANCE
  - MAINTAIN CLASSIFIED LIBRARY BETWEEN CONTRACTS

DEFENSE TECHNICAL INFORMATION CENTER

DEFENSE LOGISTICS AGENCY

R & D UNFUNDED STUDIES

US ARMY
LABORATORY COMMAND

- ESSENTIALLY A NO–COST CONTRACT
- PROVIDES GREATER ACCESS TO ARMY INFORMATION
- STUDY HAS GREATEST MUTUAL BENEFIT
- BASIS FOR EXPANDED NEED–TO–KNOW

UNSOLICITED PROPOSALS

US ARMY
LABORATORY COMMAND

TALK TO ARMY SCIENTIST OR ENGINEER

IDENTIFY ARMY PROBLEMS

IDENTIFY ADDITIONAL SOURCES OF INFORMATION

OBTAIN INSTRUCTIONS ON SUBMISSION

TILO

UNSOLICITED PROPOSAL PAMPHLET

ASK:

"WHO IS YOUR UNSOLICITED PROPOSAL COORDINATOR?"

"DO YOU HAVE AN ACTIVE BROAD AGENCY ANNOUNCEMENT?"

BROAD AGENCY ANNOUNCEMENTS

US ARMY
LABORATORY COMMAND

- DESCRIBES RESEARCH INTERESTS
- INCLUDES SELECTION CRITERIA
- EXPLAINS HOW TO PREPARE PROPOSALS
- SAYS WHEN PROPOSALS MAY BE SUBMITTED
- BAAs ANNOUNCED IN CBD

PROPOSALS ARE COMPETITIVE !

SMALL BUSINESS INNOVATION RESEARCH (SBIR)

US ARMY
LABORATORY COMMAND

ISSUE SOLICITATION . . . . OCTOBER
(ANNOUNCED IN COMMERCE BUSINESS DAILY}

PROPOSALS DUE . . . . JANUARY

PHASE I WINNERS SELECTED . . . . . MAY
(SIX-MONTH, ONE-MANYEAR EFFORT)

PHASE II WINNERS SELECTED . . . . . 9 MONTHS AFTER PHASE II AWARD
(24-MONTH, FIVE-MANYEAR EFFORT)

SBIR, CONTINUED

US ARMY
LABORATORY COMMAND

HOW TO RESPOND:

1. READ COMMERCE BUSINESS DAILY
2. ORDER SOLICITATION
3. READ CAREFULLY
4. SELECT TOPICS IN YOUR AREA OF EXPERTISE ONLY
5. ORDER BACK–UP INFO FROM DTIC
6. PREPARE PROPOSAL (WATCH PAGE NUMBERS, ETC)
7. SUBMIT ON TIME TO CORRECT ACTIVITY

BRIEFINGS & SYMPOSIA

US ARMY
LABORATORY COMMAND

ADVANCE PLANNING BRIEFINGS FOR INDUSTRY

TECHNOLOGY SYMPOSIA

INDUSTRY DAYS

CAN MIX & MATCH CHARACTERISTICS TO SATISFY GOALS

ADVANCE PLANNING BRIEFINGS FOR INDUSTRY

US ARMY
LABORATORY COMMAND

- MID– & LONG–RANGE PLANNING
- THREAT & DOCTRINE DESCRIPTIONS
- EACH RDTE PROGRAM COVERED ONCE IN THREE YEARS
- PROVIDE FOR INDUSTRY FEED–BACK
- ANNOUNCED IN COMMERCE BUSINESS DAILY

RESEARCH
DEVELOPMENT
TEST &
EVALUATION

US ARMY
LABORATORY COMMAND

TECHNOLOGY SYMPOSIA

APPROACH

- ARMY BRIEFS THREAT, DOCTRINE, & TECH PROGRAM
  - CURRENT PROBLEMS / CRITICAL TECHNOLOGIES
- INDUSTRY BRIEFS GOVERNMENT–ONLY AUDIENCE
- DOCUMENT PROCEEDINGS & FOLLOW UP
- COMBINE WITH BROAD AGENCY ANNOUNCEMENT

RESULTS

- IDENTIFY TECHNOLOGY FOR EARLY DEMONSTRATION
- IMPROVE TECH–BASE PRIORITIZATION
- IMPROVED GOVERNMENT & INDUSTRY PROGRAMS

INDUSTRY DAYS

US ARMY
LABORATORY COMMAND

TELL INDUSTRY WHAT THE LAB / CENTER DOES

- **MISSION**
- **POCs**
- **FACILITIES**

"REVERSE IR&D ON-SITE REVIEW"

TECHNICAL OBJECTIVE DOCUMENTS

US ARMY
LABORATORY COMMAND

CONTENTS

- MISSION
- INVESTMENT STRATEGY
- RESEARCH PROGRAMS
- TECHNOLOGY PROGRAMS

PURPOSE

- STIMULATE DISCUSSIONS
- ENCOURAGE PARTICIPATION IN ARMY R&D
- FOCUS UNSOLICITED PROPOSALS AND IR&D

COMPETITION ADVOCATE

US ARMY
LABORATORY COMMAND

PROMOTE FULL AND OPEN COMPETITION

CHALLENGE BARRIERS TO COMPETITION

FORCE EARLY PLANNING FOR COMPETITION

CHALLENGE RESTRICTIVE SPECIFICATIONS

PROMOTE / ENSURE MARKET RESEARCH

SMALL & DISADVANTAGED BUSINESS UTILIZATION OFFICE

US ARMY
LABORATORY COMMAND

PROVIDE SMALL BUSINESSES EQUITABLE OPPORTUNITY TO COMPETE

ENSURE FAIR PROPORTION OF AWARDS TO SMALL BUSINESSES

WHY?

- INCREASE COMPETITION
- REDUCE PRICE
- EXPAND MOBILIZATION BASE

CHALLENGE TO INDUSTRY

US ARMY
LABORATORY COMMAND

- **MAINTAIN AWARENESS OF ARMY TECHNOLOGY NEEDS**
  - REQUIREMENTS & PLANNING DOCUMENTS
  - INTERACTIONS WITH LABS & CENTERS
- **FOCUS IR&D ON ARMY NEEDS / OPPORTUNITIES**
  - RESPOND TO TECHNICAL EVALUATIONS & ON-SITE REVIEWS
- **INFORM ARMY OF ACCOMPLISHMENTS**
  - BRIEF LABS & CENTERS
  - DEMONSTRATE NEW TECHNOLOGIES